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Increasing the Train Load

Less than 10 days remain before the contest will close on the subject of Increasing the Train Load. Because of the importance of this subject to economical railway operation and the marked improvements that have been effected on several roads which have given this problem the attention it deserves, this contest is creating much interest. Several papers have already been received and others are coming in daily. We solicit for this contest the co-operation of all railway men who have given the subject of train loading careful attention, in order that all phases of this important problem may be brought out. To stimulate interest in the contest, prizes of $35 and $25 will be paid for the best two papers received, while we will also pay our regular space rates for all other papers accepted and published. The judges will base their awards primarily on the value of the ideas presented and on the completeness with which the subject is covered. All contributions should be sent to the editor of the *Railway Age Gazette*, 608 South Dearborn street, Chicago; and to be ntered in the contest, must be mailed not later than April 1.

Indorsement of Proprietary Devices

In the review of the Traveling Engineers' Association proceedings, published elsewhere in this issue, we have taken occasion to criticise the inclusion in them of remarks made in exploitation of a patented process, the merits and practicability of which are yet to be determined. This is a practice which every association of any standing should carefully guard against, especially those in a reputable and authoritative position. The material published in an official organ of any body of men is assumed to have the endorsement of that body. The general public and others who are not familiar with a mechanical device must rely on what others who are known to be expert and honest say of it. These experts should be thoroughly convinced therefore that a device is practicable and worthy of the attention of the lesser informed before they give their expert opinion on it, if the confidence of those who come to them for advice is to be retained. Further, the careful expert will also know definitely that the device is being handled by a reliable company before his unqualified approval of it is given. It is better to be over conservative than to make mistakes which will create a feeling of unreliability and distrust. The railroad associations of this country are composed of experts in their particular lines, and they should be very careful not to give official sanction to any proprietary device or method which has not proved its worth and which is not being handled in an honest and business-like manner.

Repair Shops for Electric Locomotives

It is characteristic of electric traction equipment that, although it can be made to exceed its rated capacity, the practice of excessive overloading has disastrous results on economy of maintenance and operating reliability. It is also possible to skimp on maintenance of electric locomotives, but with the ultimate result that failures will occur and repair costs go up. To secure the important advantages of service reliability and low maintenance cost in an electric locomotive, it is, therefore, necessary that the equipment be carefully operated and maintained in first class condition. Adequate shop facilities are essential to the latter requirement. The Van Nest shops of the New York, New Haven & Hartford, which were described in the *Railway Age Gazette* of March 16, page 445, provide for the most thorough work in repairing and overhauling electric rolling stock. It is evident that the New Haven officers consider the elaborate shop equipment a paying proposition, for they previously had several years' experience in the operation of a large amount of equipment with the least possible shop facilities. The Van Nest plant is a model of its kind, and while much of the equipment is special, many of the good features may be duplicated in steam locomotive repair shops. The good natural lighting, ample crane facilities, individual motor drive for machine tools, and the many time-saving devices are examples of initial expenditure made to secure economy in the cost of labor and improvement in the character of the work.

SUPREME COURT UPHOLDS COMPULSORY ARBITRATION

THE railway brotherhoods have won a battle and lost a campaign. They have gained their basic eight-hour day, and at the same time have arrayed public opinion against themselves and have indirectly caused the Supreme Court of the United States to render a decision clearly holding that Congress has the power either by providing for compulsory arbitration, or by other appropriate means to fix the wages which the train employees must accept, and to forbid them to strike.

Important developments in the wage controversy followed each other very quickly last Monday. For two days the mediators who had been appointed by President Wilson had been engaged in pointing out to the representatives of the railways and the leaders of the brotherhoods how near the United States was to war with Germany and why, therefore, the safety of the nation demanded that a strike should be averted. Its representations had no effect on the leaders of the brotherhoods, and all appearances indicated that the representatives of the railways would refuse to make any concessions in addition to those that they already had offered. Then came the news of the sinking of three American vessels by German submarines. The brotherhoods still refused to withdraw their order for a strike unless the railways would surrender and grant them the eight-hour basic day. It became evident that nothing could avert the strike but a surrender by the railways, and from patriotic considerations and disregarding their own rights, the railways suddenly made the necessary concessions.

In view of the fact that the decision upholding the constitutionality of the Adamson Act came a few hours later, it may be thought by some that the action taken by the Conference Committee of the railways was of no importance. As a matter of fact, however, the decision of the court does not say specifically how the act must be applied and, therefore, leaves room for wide differences of opinion which might easily have led to a strike had not the railways previously announced that regardless of the decision they would grant the employees a basic eight-hour day; by which is meant that they will simply substitute the words "eight hours" in the wage schedules for the words "ten hours," as the employees demanded, thereby giving the employees the benefit not only of an hourly basis of eight hours a day but also of a mileage basis of 100 miles for eight hours, or 12½ miles per hour.

Important as is the concession made by the railways under which the train employees will get an increase of wages of about $60,000,000 a year, it is overshadowed by the decision upholding the Adamson Law case, and especially by the rulings of the court as to the powers of Congress. The majority opinion, which was rendered by Chief Justice White, is published elsewhere in this issue. Among the outstanding points in it are the following:

First, that the regulatory power of Congress is so comprehensive that it has authority to adopt any appropriate means to prevent interruption of railway service.

Second, that its regulatory authority extends not only to the owners and managements of railways but also to their employees, whose rights, the court says, "are necessarily subject to limitation when employment is accepted in a business charged with a public interest."

Third, that Congress in order to prevent an interruption of railway service may fix the wages which the railways must pay and which the employees must accept.

Fourth, that Congress may provide for compulsory arbitration of labor disputes on railways as a means of preventing interruption of the service. On this last point the court is very specific, saying that "the power to provide by appropriate legislation for compulsory arbitration" is "undoubtedly possessed" by Congress and referred to it as "a power which inevitably resulted from its authority to protect interstate commerce in dealing with a situation like that which was before it."

This conclusively settles both the question whether Congress has the power to prohibit strikes on railways and the question whether it can either fix wages itself or delegate that function to some other body, such as a wage commission or the Interstate Commerce Commission. The question of compulsory arbitration is certain to come up in Congress at its next session. The brotherhoods by ordering a general strike last fall and by ordering it again when the Adamson law case was pending before the Supreme Court have made that inevitable. The decision of the Supreme Court has ruled out of Congress any discussion as to whether the government has the power to prohibit strikes. The only questions now left for it to consider are whether such legislation ought to pass, and if so, as to what form it ought to be given.

The course of the brotherhoods, it would seem, has removed from the realm of rational discussion the question whether such legislation ought to be passed. They have shown that, in the absence of legislation to prevent them, strikes on railways are certain to occur. Since "involuntary servitude" is prohibited by the federal constitution, and since the Supreme Court has held that to prohibit strikes is not unconstitutional, the "involuntary servitude" argument also is barred from future discussions.

When the members of the brotherhoods have read and thoroughly digested the decision of the Supreme Court in this case they will find that their leaders, while winning them an increase in wages of $60,000,000 a year, have also established a legislative precedent and a judicial precedent for the limitation of brotherhood activities which are likely to produce effects which both the members and the leaders of the brotherhoods were far from anticipating or desiring. The important question now is, will our politics-ridden Congress have the patriotism and courage to enact the legislation for the passage of which the Supreme Court has opened the way, and which the brotherhoods have so conclusively demonstrated is vitally necessary for the protection of the public?

LOCOMOTIVE TESTING PLANTS

THERE are three locomotive testing plants in this country, two of which have been in service for about 12 years and the third for less than half that time. The results of the investigations undertaken in these plants have been published from time to time in the form of bulletins which have been widely distributed. An article published elsewhere in this issue reviewing the tests which were made at the Altoona testing plant on the most recent class of Atlantic type locomotives built by that railroad, brings out clearly the service which the testing plant has rendered in the development of this particular class of locomotives, and the time is opportune to take stock of what the three testing plants in this country have done for locomotive engineering.

To appreciate our debt to the testing plant, let us compare the information available today with that which the locomotive designer could command, say in 1904, when the Purdue University plant was beginning its publications, and the present Altoona plant was being installed by the Pennsylvania Railroad for the St. Louis Exposition. At that time no reliable heat balance had been struck for a locomotive, and in any given design if increased boiler efficiency was desired, it was an open question as to whether more heating surface should be provided or whether the firebox should be improved. The engine efficiency was in a similar condition of uncertainty. The general effects of change of speed and cut-off were understood, but not with the accuracy since obtained on the testing plant.

Today boiler efficiency can be studied in all its details and, as the tests under review show, the designer can draw exact conclusions as to the value of the various parts of the heating surface. He can determine the proper ratio of length to diameter for the tubes and by striking a heat balance can see that at the higher rates of combustion, heating surface is much less important than efficient combustion. For the

engines full data under all conditions of operation is at hand, the effects of speed and cut-off are well charted and the designer is in a much better position to determine the proper proportions of cylinders to boiler.

The designer's knowledge has taken a more precise form in all directions and he can calculate and build with much more certainty. The reason for this lies close at hand. Tests of locomotives on the road, which were all that could be made before the testing plants were built, consume a great deal of time, accuracy of measurement is difficult, and many measurements cannot be made at all. The conditions cannot be adjusted to give exactly those desired, but are dependent on the weather, on the profile of the road and on the general train schedule. The testing plant, on the other hand, besides making the running of tests rapid and simple, has the great advantage of making it possible to eliminate all variables except that one which it is desired to study, and further, in case of uncertainty any test can be repeated under exactly similar conditions as often as is desired.

So far we have considered the testing plant as useful in furnishing exact general information for the locomotive designer's guidance. Its value is even more directly apparent when the plant is used to try out each new design before it is accepted and perpetuated. It provides a dissecting table for the locomotive on which each detail of its operation can be laid bare for criticism, and by means of which the operating department can see whether the designer has been successful and whether the horse-power delivered under varying conditions is in proper proportion to the cost and weight of the engine and to the coal consumed. In other words, the plant offers an opportunity for checking the commercial efficiency of a design.

It is not impossible to try out on the plant two locomotives, one 50 per cent heavier than the other, and find that at 10 miles an hour the power delivered is in proper proportion to the weights of the engines, but that at 20 miles an hour the larger engine can give no more power than the smaller. This instance, although founded on fact is possibly an extreme case, but even with a smaller difference in efficiency there is a high dollars-and-cents value in discovering discrepancies in design, and in being able to determine readily the cause and the cure.

As locomotive design improves the necessity for the testing plant increases because the margin of difference between the various designs decreases, and consequently becomes increasingly harder and in many cases practically impossible to measure in road trials. For example, a difference in tube length of two feet may make a difference of five or ten per cent in the boiler efficiency. This multiplied by say 50 locomotives and extended over a year would mean a saving well worth while. But without a testing plant the comparison of the two boilers would be a matter of considerable uncertainty because of the impossibility of making tests on the road under conditions sufficiently similar not to obscure the difference it is desired to measure. Besides furnishing general information for the designer, and a means of checking up his work, the testing plant is convenient for developing special appliances or for improving certain parts by direct trial. Working along these lines, the Pennsylvania Railroad has, to mention only a few of the problems successfully attacked, used the Altoona plant to work out the most effective design for blast nozzles, to develop a standard form of front end, and to arrive at the proper size of piston valves.

In spite of the amount of work the testing plants have done, it is clear that there is a great deal still to be done. Besides the ever present work of checking new designs and improving details there are a number of questions in the general operation of the locomotive which could be studied with advantage.

Of the three plants in this country, that of the Pennsylvania Railroad has been in constant service since its transfer to Altoona at the close of the St. Louis Exposition, and it is to this plant that we owe most of the information referred to above. The Purdue plant shares with the Chicago & North Western the credit for pioneer work in the field of locomotive testing, but has not published much information lately. In September, 1915, the Urbana plant of the University of Illinois published its first report which was most disappointing. It adds nothing to our knowledge of locomotive operation, and marks no advance in locomotive testing. It is to be hoped that we shall soon have from this plant work more worthy of the excellent equipment.

Urbana and Purdue have opportunities for most valuable work if they can bring the railroads to realize the full value of the locomotive testing plant. The roads have yet to grasp the practical value of the work already done, and to comprehend the necessity for going further. The testing plant can and should be a most important factor in securing efficiency in locomotive design and operation; in fact we believe it is an essential factor in obtaining the highest efficiency and as such deserves the most careful consideration from every railroad executive responsible for the purchase or operation of motive power.

BETTER FREIGHT CONTAINERS A NECESSITY

AN article in the Santa Fe Magazine some months ago said, "Why have not the railroads, not only in justice to themselves but in justice to society, the right to demand of the shipper a container for his goods that cannot be entered hurriedly without leaving unmistakable evidence of it, so that when a pilferage occurs we will know it forthwith and be in position to trace the theft right down to the perpetrator before he has had an opportunity to make his getaway or cover his tracks?"

At the present time there are on the railways two strong tendencies diametrically opposed the one to the other. On the one hand is the tendency toward the use of larger and heavier cars while on the other is the tendency toward the use of lighter and weaker containers. There are many reasons, and good ones, for the use of the larger car; the continued growth of the automobile traffic may be instanced as one, the use of heavier locomotives as another, the progress of the art as a third. There are many reasons, but few justifications, for the use of the lighter and weaker containers. The high cost of lumber is one reason, the use of fibre cases another and the laxness of the carriers a third; and of these the last is the greatest—or rather the last is the most inexcusable. The shippers may be expected to use the lightest and frailest containers that they can "get away with." The lighter cases are cheapest, the freight to be paid on a particular shipment is less and if an obliging railroad will make good any losses that may be sustained by damage or pilfering, why should the shipper worry?

But this is not as it should be. In its broader aspects it is uneconomic in the extreme. For instance, when these frail containers are used, the shipments in them are frequently "top load" freight, meaning that the handlers must be exceedingly careful in stowing the freight and that they must take extra efforts to see that the heavy articles are on the bottom. This results in loss of time and labor. If the shipments in the car are almost all in frail containers they cannot be piled high without danger to the articles below. This matter has received the attention of loss and damage committees again and again with the result that it is not unreasonable to suppose that often cars are not loaded as high as they might be to secure the greatest efficiency in loading. And car loading is a very pertinent matter.

On the average, freight cars are loaded to less than 55 per cent of their capacity. This, in great measure, is beyond the control of the carrier. There are many instances where the minimum weights on car load shipments are much too low to insure the full use of a car. It is also true, on the other hand, that in some cases the carrier is

unable to supply a large enough car for the shipment so that two cars must be supplied, with the result that one or both may be utilized to much less than capacity. A great many cars used in local l.c.l service cannot be loaded to capacity because there is not enough freight on hand for the stations to which the cars are going. But it still holds true that in a considerable number of cases the loss and damage agitation on the railroads and the desire of the shippers not to pile their goods too high to the detriment of the frail containers on the bottom have resulted in lighter carloads. If stronger containers were demanded this cause would be removed. If the average loading of cars were increased only five per cent it would actually release 125,000 cars from service and it is easily seen what a saving the use of stronger containers alone would make in more efficient car loading.

But the question arises, Do the railways need cars at the present time? They do; but they need car efficiency more. Especially is this true of the terminal roads in the east. They need motive power to move their cars and they need terminals. The use of stronger containers would permit more efficient car loading. Each car occupies a certain length of track and for a certain time. If it were more heavily loaded the track and terminal space would be more efficiently used. This will help relieve the congestion, for the same business could be handled in fewer cars, requiring fewer locomotives to haul them and occupying less track and terminal space.

The question of pilfering is not so much a matter of protection as it is of detection. It is a comparatively easy matter to open the average container, remove an article from within, and close it up again so that no trace of the theft appears. The fact that of the total claims paid by the Santa Fe in one six-month period 24 per cent were for unlocated loss and 20 per cent for unlocated damage shows plainly the necessity for a container from which goods cannot be taken without evidence of that fact.

Admitting the advantages of the strong and perfect container, what incentives are there for the carriers to use such containers. This is a hard question to answer. It has been demonstrated that it is almost impossible to insure the presentation of shipments adequately packed. Many means have been tried, such as policing at the outbound receiving platforms, "jacking up" the agents, and other things, but in nearly every case the only result has been to secure only temporary relief not at all commensurate with the cost and time expended to secure improvement.

Apparently there will be no relief until the railways are willing to offer some kind of a reward for shipments in stronger containers. How may they do this? One suggestion is to permit the use of strong, indestructible containers, but to allow the shipments in such containers to be assessed at their net weight, that is to carry the container free of charge. This would be rather an innovation but the idea merits consideration. Perhaps a better way might be to permit a reduction in the classification sufficient to make it worth while for the shipper, or rather to encourage him, to use such a container; there are better precedents for this, for it is recognized that the method of packing a commodity is one of the several things regulating its classification. The carriers, of course, can object that they will lose a considerable amount of revenue if either of these ideas is made effective. This is true, but are they not already losing money through the shippers' use of lighter and frailer containers? Is it not a fact that whereas the shippers once used heavy wooden boxes or cases they are now using lighter packages with resulting reduced weights on their shipments? And is it not a great disadvantage to the carriers that the use of the light containers is losing them money in loss and damage claims, and that there is an economic loss in the form of reduced car efficiency?

Of course the specifications for such containers will have to be extremely rigid if shipments in them are to be better protected. The railways will have to require that the containers be as near a perfect protection for the articles within them as possible. They must require that they be of reasonable size and weight and that they have handles, or, in other words, that they be so made that they can be easily and efficiently handled. They will have to demand that all shipments made in such cases be clearly marked with the name of the consignee; possibly the manufacturers of such cases will provide a recess in the side of the container for a tag of some kind. This point cannot be too strongly emphasized, for it is a fact that the lack of proper marks on shipments is almost as bad an evil as unlocated loss.

Another of the important considerations is the seal. It will be a positive essential that all cases be so locked or sealed that if the shipment is molested in any way the fact of a theft will be instantly and plainly apparent. If such containers can be made, and it does not seem unreasonable to believe that they can, and will be, the railways will make no mistake in looking into the matter of their use with a great degree of interest and attention.

NEW BOOKS

Master Blacksmiths' Proceedings. Edited by A. L. Woodworth, secretary, Lima, Ohio. 200 pages, illustrated, 6 in. by 9 in. Bound in cloth. Published by the association.

This book is the official report of the twenty-fourth annual convention of the International Railroad Master Blacksmiths' Association, which was held at the Hotel Sherman, Chicago, Ill., August 15, 16 and 17. It contains discussions on flue welding, frame making and repairing, drop forging, tools and formers, spring making and repairing, carbon and high speed steel, oxy-acetylene and electric welding, case hardening, heat treatment of steel, and a paper on the use of powdered coal in blacksmith shops.

Proceedings of the Traveling Engineers' Association. Illustrated, 390 pages, 6 in. by 8½ in., bound in leather. Published by the association, W. O. Thompson, secretary, New York Central Lines, Cleveland, Ohio.

The Proceedings of the Traveling Engineers' Convention, which was held in the Hotel Sherman, Chicago, October 24, 25, 26 and 27, 1916, contains papers and discussions on the following subjects: The Effect of Mechanical Placing of Fuel in Locomotive Fireboxes on the Cost of Operation; Advantages of Superheaters, Brick Arches and Other Modern Appliances on Large Locomotives; Difficulties Accompanying the Elimination of Dense Black Smoke; Recommended Practice in the Make-Up and Handling of Modern Freight Trains on both Level and Steep Grades to Prevent Damage to Draft Gear; Assignment of Power from the Standpoint of Efficient Service and Economy in Fuel and Maintenance, and How Best to Educate the Road Foreman, the Engineer and the Fireman.

In connection with the remarks on firing with powdered coal, printed on page 78 of the proceedings, considerable was said in exploitation of the Powdered Coal Engineering & Equipment Company's "carburization" process. While the burning of powdered coal is feasible and has been in successful use for a number of years in metallurigical furnaces, the apparatus of this particular company is still in the experimental stage and its commercial value has yet to be determined. It is unfortunate, therefore, that the association should give its official approval by publication in its proceedings to this product, the merit of which is still undetermined. In this particular case there is further cause for regret because of the method which this company is using in exploiting its products. From its circulars and advertising matter it appears to be more interested in influencing people to buy its stock by means of extravagant theoretical claims for its product, than in developing and selling its fuel burning system.

Letters to the Editor

DISCOURTESY TO EMPLOYEES

PEORIA, Ill.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In your issue of February 23, there appeared a letter to the Editor, entitled "College Men and the Railroads," which expressed a spirit that I am so sure is entirely wrong that I want to protest vigorously against it.

I have been in the employ of railroads since 1887, when I started as a clerk in a local freight office, and am still a clerk, though an auditor of a railroad. I have carried annual passes and Pullman passes for a good many years, being compelled to travel quite extensively, and have yet to be shown a discourtesy because I was an employe of a railroad. There are many college men working for railroads, though I am not a college man myself.

I have occasionally ridden in upper berths, but why shouldn't I if there is a pay passenger who wants the only lower left. The railroad companies which pay us our salaries are in the transportation business, and their only source of income is from the sale of transportation to the public, so why should not a loyal railroad man be glad to give way to the paying public, even, if necessary, to sleep in an upper berth in order that he may accommodate a man who is paying his money for transportation.

The clerk who wrote the article is wrong in his conception of railroad transportation, and either ought to change his viewpoint or seek some other employment. In my judgment, there is no more honorable or legitimate employment than in the transportation business. It is one of the most useful, as well as fascinating, occupations in which men are engaged, and I am truly sorry for a man who feels about the business in which he is earning his daily bread as does the author of the article in question.

H. L. STUNTZ,
Auditor, Peoria & Pekin Union.

BUFFER CARS FOR PASSENGER TRAINS

NEW YORK.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The writer has read with great interest the editorial in your issue of March 9 on the Mount Union Collision. While entirely in sympathy with your conclusion, I reflect that it will be many years before the railroads of this country could be so equipped as to afford proper protection to their passenger trains from such accidents. But it would be entirely feasible to take immediate action to prevent such wholesale loss of life. Enact a law compelling the running at the rear end of all passenger trains of not less than 100 ft. of cars loaded with merchandise and carrying no passengers. It would seem entirely feasible to utilize these cars for carrying through express matter, so that the railroad company would suffer very little if any, loss in putting these loaded cars on passenger trains. It would, of course, mean a somewhat shorter train, so far as passenger accommodations are concerned, or might necessitate some double heading. What valid objection could the railroads offer to such a requirement?

E. H. DEWSON,
Mem. Am. Soc. C. E.

[What objections could the railroads offer? Well, not nearly so serious objections as a few years ago. The parcel post, in itself, and as a stimulator of express traffic, has so increased the demand for the transportation of merchandise at high speed that the cushioning of passenger trains would not now, as in former years, involve the running of empty cars, baggage or freight, or carloads of wheat or lumber. It would hurt an American manager's pride thus to constantly remind himself of the imperfection of his system of train protection; but there are railroads where the officers have never yet indulged in such pride; there are, we believe, state-owned railroads in Europe on which the rule to have always a baggage car at the front end of a passenger train, is still in force. The principle is about the same, whether the buffer car be at the rear or at the front. If such a car is used at all, both ends of the train should be protected. Many passenger-train collisions, no doubt, during the past ten years, have escaped being included in the "fatal" column of the statistics only because the car at the end, which took the brunt, was empty or was only partly occupied. Such an occurrence hurts the superintendent's pride, also. The real objection to the plan is that it would be another device for preventing the *effects* of collisions, rather than for removing their *causes*. If more energy were devoted in this country, by railway officers and lawmakers, to removing the *causes* of accidents, we should less frequently have their effects; but as long as the labor brotherhoods are in control of the situation the want of discipline, which is a chief cause, will continue to produce its characteristic results.—EDITOR.]

LATERAL THRUST OF THE WHEEL ON THE RAIL

NEW YORK CITY.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In your issue of February 22, Lewis E. Moore discusses the pull of trains of different methods of make-up on the inner rail of a curve. In it he says: "Unless, therefore, the speed is great enough to cause the cars to run against the outer rail of the curve, . . ." From this it may be inferred that he considers that, at low speeds, the wheels do not run against the outer rail. In this he is in error, for no matter how slowly the train may be moving the leading wheels of car trucks and locomotives have a flange bearing against the outer rail, and every wheel in a train will exert an outward thrust against it. The amount of this thrust is a function of the speed of the train, the character of the truck or the wheel base, the weight and the character of the loading, and, I am inclined to think, the condition of the treads of the wheels. Tentative formuli have been worked out for a number of types of locomotives, but nothing has been done for cars with the exception of learning, incidentally, that the indications are that the outer thrust is greater per unit of weight than it is for locomotives. So while his general proposition may be true, that a train with the loads at the rear pulls harder than one with the loads at the front, it will not do to assume that the car is dependent upon centrifugal action to bring its wheels against the outer rail.

GEO. L. FOWLER.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The above communication from Mr. Fowler shows me that I must have been a little careless in stating the assumptions upon which my original communication was based, or he would not have inferred that I meant to state that, in actual practice, car wheels ran against the inner rail at low speeds. For the sake of attempting to develop the analysis of observed phenomena it is often necessary to remove obscuring conditions, or in other words, clear away the underbrush. In attempting to do this and, at the same time, to condense my communication as much as possible, I assumed a perfectly flexible wheel arrangement without specifically so stating. With this assumption admitted, I believe my analysis is correct. Whether the assumption was too sweeping or not is another question. My analysis was an attempt to indicate a possible effect of certain elements on train resistance on curves, and was by no means intended for an attempt

at a complete analysis of that very intricate problem. In view of Mr. Fowler's exceptional opportunities for study and observation in this connection, his remarks are extremely interesting.

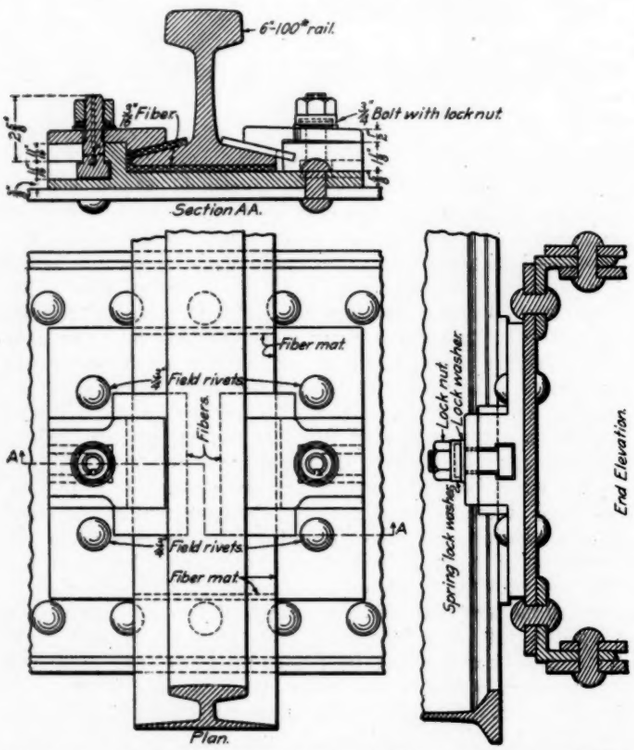
LEWIS E. MOORE.

INSULATING RAILS ON TROUGH BRIDGE FLOORS

NEW YORK CITY.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

In the *Railway Age Gazette* of November 3, 1916, there appeared an article on "Special Protection for a Drawbridge" which the Chicago, Rock Island & Pacific operates at Rock Island, Ill., and in the same issue editorial comment was made on the fact that the rails on this structure are laid directly on transverse steel troughs and that the insulation of the rails on this structure would have been prohibitively expensive both in first cost and maintenance. While the designing policy advocated in this editorial seems to me thoroughly sound, there are a number of existing trough bridges which may have to be arranged for carrying a rail with a track circuit in it without danger of grounding, and



Method of Attaching Rails to Steel Floor on Harlem River Bridge of New York Central

there are occasional places where the clearance between the rail and the bottom of the supporting steel should be small. In such instances it may be quite desirable to have a form of construction involving the rails being supported directly on the bridge steel. It might be interesting, therefore, to consider what has been done to accomplish this, for it has been accomplished probably in a number of ways.

On the New York Central bridge over the Harlem river at Park avenue, New York City, the propulsion circuit, negative return, as well as the signal circuit, is carried through the rails and the train movements are considerably in excess of those quoted as moving over the bridge at Rock Island. The accompanying illustration shows the method of insulating the rail from the trough floor, which was installed on this bridge about nine years ago and has worked successfully since. The first cost of this installation was not prohibitive, certainly as compared with any change in form of bridge structure, and the maintenance of the connection compares favorably with the maintenance of standard track of a similar length. In fact, there has been little maintenance on this track except occasional renewals of bolts and nut locks and periodical renewals of the fiber touching the rails. The average life of the fiber mats, which are directly under the rails, has been two years, while the average life of the small clips on top of the base of the rail has been 3.2 years. These averages include all renewals and some changes made when the work was first installed to improve the design.

No doubt there are other methods of accomplishing the same result, but I am taking the liberty of describing this scheme on account of the reference to the prohibitive cost of such insulation in the article and editorial referred to.

FRANCIS BOARDMAN,
Division Engineer, New York Central, Electric Division.

A SHIPPER'S APPEAL TO SHIPPERS

PITTSBURGH, Pa.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The tremendous increase in business throughout this country has created a large number of embargoes, resulting in the greatest car shortage that the shipping public has ever been afflicted with; a shortage resulting in almost regular banking of blast furnaces and the shutting down of steel mills intermittently. The spring will bring the opening of navigation on the Lakes, when the demand for cars for Lake coal will be increased; and there will be very little improvement in the car supply, unless the shipping public can be aroused to a full appreciation of this very serious problem.

While there have been some great strides made in the adoption of modern equipment of large capacity and improved methods for heavier loading of cars, the increased volume of traffic has far exceeded the most advanced plans of the railroads; though they have grappled with the situation in a heroic manner, attempting to handle traffic that would be sufficient to support nearly double the number of railroads that we have today, or, at all events, double the facilities and rolling stock in the section east of the Mississippi river. If shippers will do their part toward utilizing equipment to the fullest extent and consignees unload all cars promptly at destination, they will do more toward clearing up a very bad situation than by criticising the overtaxed railroad men.

The twelve shipping companies of the United States Steel Corporation have conducted a vigorous campaign for the heavier loading of cars, and during the year 1916 the average carload of these companies was 80,400 pounds per car, a remarkable showing. The twelve companies increased the average carload on outbound shipments only 1,800 pounds per car but this effected an actual saving of 37,202 cars, as compared with the loading for the year 1915, when the average was 78,600 pounds per loaded car. These twelve shipping companies actually forwarded 1,495,520 more tons of traffic than if the practice of loading one year ago had been followed, and this increased traffic was enjoyed by the railroads without any additional operating expenses.

It is gratifying to notice in a recent issue of the *Railway Age Gazette* a very full description of the new 85-ton hopper car, recently constructed by the Pennsylvania; with the 10 per cent allowed above capacity, this car will carry 187,000 pounds, or 93.5 tons, and this really means that the 100-ton car will soon appear.

J. F. TOWNSEND,
Traffic Manager, National Tube Co.

PREPAYMENT OF ENGLISH FREIGHT CHARGES.—The Railway Executive Committee has issued a notice that from April 2 the carriage charges on all descriptions of traffic sent by passenger train must be prepaid.—*The Engineer, London.*

Congressional Inquiry On Railroad Regulation

Hearings Before Congressional Committee on Interstate Commerce Resumed. Statement by R. S. Lovett

THE Congressional Joint Committee on Interstate Commerce, appointed under a Congressional resolution to conduct an inquiry into questions pertaining to government regulation and control of transportation and public utilities, resumed its hearings at Washington on Monday, March 19, after having suspended since December 9 during the concluding session of Congress. Alfred P. Thom, counsel for the Railway Executives' Advisory Committee, appeared for the completion of his cross-examination by members of the committee, but it was decided to defer this until a later date, and Mr. Thom introduced Robert S. Lovett, chairman of the Union Pacific. Judge Lovett read a lengthy statement, which was not completed on Monday, and continued it on Tuesday. An abstract of his statement follows:

STATEMENT BY R. S. LOVETT

I am not here to plead the case of the Union Pacific. As a matter of fact, that company's credit has been so high that it has had no difficulty in raising the money it needed during the last ten years; and its present resources are such that I do not apprehend difficulty in providing the funds it may require for several years to come. Furthermore, it has been less harrassed by conflicting state laws and commission regulations than many other companies.

Problems of the Railroad Situation

But addressing myself to the railroad situation of the country generally, as I have observed it, I believe that the problems are:

First: The multiplicity of regulations by the several states with respect to the issue of securities, involving delays, and conflicting state policies generally dangerous and possibly disastrous.

Second: The state regulation of rates in such manner as to unduly reduce revenues, to discriminate in favor of localities and shippers within its own borders as against localities and shippers in other states, and to disturb and disarrange the structure of interstate rates.

Third: The inability of the Interstate Commerce Commission, whoever the commissioners may be, to perform the vast duties devolving upon the commission under existing laws, resulting in delay—which should never occur in commercial matters—and compelling the commissioners to accept the conclusions of their employees as final in deciding matters of great importance to the commercial and railroad interests of the country.

Fourth: The practical legality that has been accorded conspiracies to tie up and suspend the operation of the railroads of the country by strikes and violence, and the absence of any law to compel the settlement of such disputes by arbitration, or other judicial means, like all other issues between citizens in civilized states are to be settled.

Fifth: The phenomenal increase in the taxation of railroads in recent years.

Sixth: The cumulative effect of these conditions upon the investing public, to which railroad companies must look for the capital necessary to continue developments.

Of course, no one knows the amount of money that will be required for proper railroad development in the future. Is it not, in the circumstances, conservative to say that, as we spent an average of $600,000,000 per annum during the last 10 years, we shall require a great deal more than that during the next? This takes no account of the outstanding bonds which are beginning to mature, and will have to be paid off through refunding. Those who have made some investigation estimate the amount at upwards of $200,000,000 per annum, which in forecasting the future will have to be added to the amount required for betterments, additions (including equipment) and construction.

In support of my opinion I beg leave to cite particularly the case of the Union Pacific. Now, notwithstanding the notable constructive work planned by Mr. Harriman's genius and carried on under his administration, and notwithstanding the very general impression throughout the country that he had completely rehabilitated the Union Pacific, the fact is that more money has been spent by the Union Pacific System for additions and betterments (including equipment) and construction, in the seven years since Mr. Harriman's death than during the entire 12 years of his administration, $158,026,963 from 1910 to 1916 as compared with $119,152,471 from 1899 to 1909.

I may add that the budget for 1917 calls for larger expenditures upon the railroads in 1917 (excluding new lines) than we have made in any one of the past 10 years. It appropriates about $35,000,000.

A Question for the Government

What is true of the Union Pacific with respect to the need of expenditures is largely true of every enterprising railroad system in the country, particularly in the newer sections; and the question is how and from whom is the money to be gotten. That question under government regulation is quite as much for the government as for the railroad officers.

At the moment, the railroads are prosperous. The year 1916 was the most prosperous as respects gross revenue in the history of the railroads of this country, and 1917 is beginning well. But we all know this was due to the abnormal conditions now existing in the world, and that in time—whether one, two or three years—the railroads will get back to where they were in 1914; and, unless a wise system of national regulation is adopted, their position will become much worse than then. Even at the present time they are feeling severely the "high cost of living" falling upon everyone. For example, the Union Pacific bought Mikado engines in 1913 for $23,600; in 1916 the same engines cost $35,800; and in February, 1917, the same engines cost $44,000. Passenger engines bought in 1913 cost $23,000, while the same engines bought in February of this year cost $41,000. Switch engines that cost $14,000 in 1913 cost $26,000 in 1917. These prices are, of course, abnormal, and we have bought only what we were compelled to buy, but they are no more abnormal than our large earnings during the same period.

I mention these circumstances only to show that the railroad problem is no wise solved by the present apparent prosperity, but that, on the contrary, it is time to consider and devise a sound solution of the difficulties which otherwise will soon confront us in even more acute form.

Multiplicity of Regulation

This country is only beginning to feel the effect of the multiplicity of regulations by the several states with respect to the issue of railroad securities. Nineteen states now have it. This power is new. The great trunk lines in the East—Baltimore & Ohio, Erie, New York Central, Pennsylvania, and others in that territory—were not subject to it at all 10 years ago, but today they must get the consent of not less than six state railroad commissions before they can issue any

stock or sell any bonds to raise money, and such consent is given in most, if not all of them, only after application, notice, hearing and deliberation by the commission that sometimes makes ordinary court procedure seem like speeding. In Union Pacific territory, only three states—Missouri, Kansas and Nebraska—have had the power. In the South, Georgia and Texas are apparently the only states exercising the power. Since the fashion has started, it is not at all improbable that all the states will soon follow it.

All the great trunk lines of railroad in the section lying north of the Potomac and Ohio rivers and bounded on the west by the state of Illinois and on the east by New York, constituting the heart of the manufacturing, commercial and financial interests of the country, must apply to four or five, and, if they enter all the states in that section, as some of them do, to as many as seven different state railroad commissions, by formal petition, produce witnesses, have a hearing, and satisfy the varying views of the many commissioners, influenced perhaps in many cases by purely local, rather than national, considerations, before they can issue bonds or borrow money. It is really not surprising that the sudden shackling in this manner of these great trunk lines, whose securities are in the hands of almost every investor, great and small, should have made a profound impression upon the railroad investing world. The increasing activity of these commissions, as they feel more and more their power, and with the conferring of the power upon commissions in other states, will add to the difficulties, unless Congress exercises its right to exclusively regulate the capitalization and financial operations of these interstate railroads.

It is true, of course, that some delay and publicity will attend any commission regulation of the issue of securities. But it is obvious that if supervision of only one commission is required, the delay will be far less, and that commission, with the greater experience it will have in dealing with such subjects, will acquire an expertness and familiarity with all conditions involved, that will not only greatly expedite the proceedings, but enormously increase the efficiency and wisdom of the supervision.

The difficulties are not merely potential. They are actual; and with the increasing number and power of state commissions, the difficulties of financing railroad improvements will become insuperable. The Union Pacific, for the privilege of issuing some bonds under a mortgage covering its lines extending from the Missouri river to Ogden, with only a few hundred feet of track in Missouri, at Kansas City, had to pay recently to the state of Missouri for the approval of such issue by the Missouri commission a fee of $10,962, when only $124,930 of the money represented by the bonds had been expended upon its property in that state.

Indeed, some states, in effect, deny railroad companies the right to borrow money for improvement at all. During the life of Mr. Harriman he planned to build a low grade line connecting with the Union Pacific at Kansas City, thence to the boundary of Texas at Denison, there connecting with the Houston & Texas Central line, controlled by the Southern Pacific, and practically to rebuild that line from Denison to Houston and Galveston, in order to establish a low grade line from Kansas City to the Gulf. As counsel, I was obliged to advise him that under the Texas law and the ruling of its railroad commission, not a dollar in bonds could be issued for the money required in the reconstruction of the Houston & Texas Central; and even if stock could be issued at 100 cents on the dollar for the money thus expended, as a practical matter it could not be sold, since stock ownership was the only way by which the Houston & Texas Central could continue as part of the Southern Pacific System, a lease or sale of the railroad itself to the Southern Pacific Company, or any foreign corporation, being forbidden by the laws of Texas. The result was that a great project for improving the facilities for interstate and international commerce had to be abandoned, and the choppy grades of the Houston & Texas Central continue as they always have been, and probably always will be as long as the Texas law remains unchanged.

The money needed for the improvement of the Texas lines of the Southern Pacific and Santa Fe systems, when forthcoming at all, has been furnished by the parent systems by direct loan without security from their treasuries outside of the state, and by foregoing dividends of the Texas companies from time to time to which they were fairly entitled. Much of the lines mentioned—more than half of the Southern Pacific from the Louisiana boundary and the Gulf to the New Mexico boundary—is unproductive and would not pay operating expenses except for the through business. No argument should be needed to show that the transcontinental lines of railroad extending from New Orleans, on the Mississippi river, and Galveston on the gulf, to the Pacific Ocean, and the lines from the grain fields of Oklahoma, Kansas, Missouri, Nebraska, Iowa, etc., to the gulf—particularly those under the same stock ownership and operated as a single line—ought to be regulated, in their financial operations, at least, by the government that regulates interstate and foreign commerce.

What is true of the Southern Pacific and Santa Fe lines in Texas is true, more or less, of all the other lines in that state. Railroad construction in Texas since the enactment of the law in 1893 has been limited to building by large railroad systems operating outside the state, in order to reach the gulf, or as feeders to the main system. Every case of any independent railroad construction in Texas since 1893, without a single exception which I can recall, has proven disastrous and ended in a receivership.

Again, the right to extend an existing system of railroads by building a new line, or buying or leasing an existing line, comes only from the states. Congress makes no provision therefor, although the object may be exclusively the extension and promotion of interstate and foreign commerce. Each one of the large railroad systems of the country derives its existence from some state, and that state can paralyze the development of the system in other states by imposing restrictions upon the capitalization, or otherwise, if it should choose to do so; and where the line traverses several states, any one of the states can, at least, prevent development through raising money on mortgage bonds, if not through the issue of stock, by refusing to permit the mortgage on that portion of the system within such state. It will not do to say that the states are not likely to exercise this power. As a matter of fact, they do. I have already cited the case of Texas. That state goes further and does not allow a corporation of any other state to own or lease or operate a mile of railroad within its territory. And there are others. Several of the states will not permit the sale or lease of any part of a railroad without the approval of the state commission. Following the decision of the Supreme Court holding illegal the control of the Southern Pacific by the Union Pacific, the attorney general insisted, as a part of the dissolution procedure to be worked out in the court below, that the Southern Pacific should sell and that the Union Pacific should buy the Central Pacific Railway, which the Pacific Railroad acts of Congress, aiding its construction, required should, in connection with the Union Pacific, be operated, so far as the public and government were concerned, as "one continuous line of railroad from the Missouri river to the Pacific ocean." Under pressure from the attorney general, the Union Pacific and Southern Pacific arrived at and executed an agreement for such sale. But an essential feature of the agreement was the joint use by the two systems of certain terminals at Sacramento, Oakland and San Francisco, and the joint use of certain tracks of the Southern Pacific between Sacramento and Oakland, and a lease of the Central Pacific between Tehama and the Oregon boundary to the Southern Pacific.

The California commission would approve the contract only on condition, in substance, that other lines should be

admitted to the joint use of such properties on such terms as the commission itself might fix, and that the rentals for the joint use of the properties should be fixed by the commission—conditions which, of course, no solvent railroad company could afford to accept. Consequently, the agreement failed.

Now, I do not wish to be undestood as criticising the California commission for its action in the matter just stated, or to express any opinion as to the wisdom of its action from any standpoint. I mention it only as an instance where as able and enlightened a commission as that of the state of California prevented an otherwise lawful contract for the establishment, under one management, of a great national highway, and prevented the carrying out of a definite plan of two successive national administrations, as reflected by action of the attorney general in each. Whether the result was beneficial or otherwise to the public, is, of course, not for me to say. The whole point I make is, it was a matter that should be for the determination of the national authority and not for a single state.

Access to our Pacific Ocean coast from the Mexican boundary on the south to Oregon on the north, a distance of almost 1,000 miles, is through the state of California. Indeed the only accessible ports between Mexico and the mouth of the Columbia River, a stretch of 1,280 miles, are within California. Access to the Gulf of Mexico between the Mexican boundary and Louisiana is through the state of Texas, and the only practicable access to the Gulf between the mouth of the Mississippi river and Mexico, a stretch of some 670 miles, is through the Texas ports. With the California commission controlling access to most of our Pacific Ocean coast and local rates to and from the ports, and with the Texas commission controlling access to most of the gulf coast ports and the local rates to and from those ports, it is to be expected that the commissioners of those states will be undisposed to relinquish their power over the "hinterland," and will oppose every move for the exercise by Congress of its full constitutional power over interstate and foreign commerce.

I believe very strongly that it is absolutely necessary for the adequate development of the railroad transportation of this country for Congress to exercise the powers vested in it by the Constitution, rather than the states, to the extent, at least, of controlling exclusively the issue and sale of securities by railroad companies, and the establishment and extension of interstate railroad systems by construction, purchase, lease, consolidation or otherwise. The credit of such systems depends upon the cohesion of the constituent factors, and the legality of the combination. Undoubtedly there should be a veto power upon the construction of unnecessary lines, and upon sales, leases and consolidations, but I submit that the power should be vested in Congress, or a congressional agency, such as the Interstate Commerce Commission, and not in the states.

State Regulation of Rates

Coming now to the second difficulty I mentioned, namely, state regulation of rates in such manner as to unduly reduce revenues, to discriminate in favor of localities and shippers within the state, and disturb and disarrange the structure of interstate rates, but little need be said, since the facts are familiar. Most of you know that many of the states, by legislative action, or commission order, have reduced passenger fares to two cents per mile, while interstate rates are higher; and that interstate passengers in such circumstances are able, and many of them do, by buying tickets to intermediate points, etc., travel at a lower rate than that prescribed by interstate tariffs filed with the commission. Similar discriminations are commonly practiced with respect to freight. My understanding is that at about the time the Interstate Commerce Commission granted the eastern roads an increase of rates in the early stages of the European war, as a necessary relief from serious financial distress, the Pennsylvania commission ordered a reduction in coal rates involving a loss of revenue to the roads affected, almost equal to the gain to result from the increased rates allowed by the Interstate Commerce Commission. It has not been unusual for states and state commissions to reduce rates while the Interstate Commerce Commission was increasing, or considering applications to increase rates.

Some of the state commissions in effect control interstate rates through their power over intrastate rates and their willingness or threat to use such power to punish railroads who disregard their wishes with respect to interstate rates.

Of the total freight revenue of the Union Pacific System for the fiscal year ended June 30, 1916, 87.9 per cent was derived from interstate and foreign traffic, whereas the largest intrastate revenue furnished by any one state was 2.8 per cent, while the lowest was one-tenth of one per cent. The percentage of intrastate passenger revenue was somewhat larger, ranging from six-tenths of one per cent to 7.6 per cent, while interstate passenger traffic was 68 per cent. Yet any one of the states could block the financial plans for a considerable part of this railroad system, if not for the whole, if it so willed. Happily, the states traversed by our lines have been considerate and co-operative in helping us in our work of upbuilding and development.

The third difficulty which I specified is the inability of the Interstate Commerce Commission, no matter who the commissioners may be, to perform the duties devolving upon the commission, under existing law, resulting in delay and compelling the commissioners to accept the conclusions of their employees as final in deciding matters of great importance to the commercial and railroad interests of the country. If the duties of the commission should be enlarged, if only to the extent of supervising and regulating the issue of railroad securities, the conditions will, of course, become worse, and the delay intolerable; and some provision for the relief of the commission will become absolutely necessary. We believe that the Interstate Commerce Commission is now, and ever since its creation has been composed of hard working men, and that they are doing quite as much as men in such positions can do. But their task is too great. The commissioners are charged with the duty of hearing and deciding issues more important to the commerce and business of this country than are many of the cases decided by the Supreme Court of the United States. But they are dependent upon subordinates for the hearing and recording of the testimony, which is so voluminous that it is not humanly possible for all the commissioners to read it after it is taken. Upon a record thus made and upon arguments and briefs often, I dare say, conflicting in statement, the commissioners must decide these matters of far-reaching importance to the public as well as to the railroads, and perform all their other duties of supervision, detection and correction, embracing accounting, statistics, rates, discriminations, boiler inspections, and safety appliances, with an odd job added now and then by resolution of Congress for the investigation of some transaction.

Labor Conspiracies

The fourth difficulty I mentioned is the practical legality that has been accorded conspiracies to tie up and suspend the operations of all the railroads of the country by strikes and violence, and the absence of any law to compel the settlement of such disputes by arbitration or other judicial means. However men may differ about the Sherman act as applied to wage disputes and the abrogation by the Clayton act of the ancient right of protection by injunction, it does not seem to me that there should be serious difference of opinion upon the proposition that no body of men should be allowed to form a conspiracy, and openly carry it out, to stop the operation of all the railroads of the United States—thus suspending all interstate and other commerce and paralyzing the very life of the nation, no matter what their object

may be. It seems inconceivable that a nation as dependent as ours is upon railroad transportation should permit this to occur. It seems to me that one of the plainest duties of the national government, not merely to the railroads, but to the whole people, is to provide a means for settling disputes between the railroads and the trainmen likely to lead to such strikes. Men cannot be compelled to work against their will, and no one suggests this. But men can be forbidden to enter into and carry out a conspiracy to interfere with and suspend interstate commerce.

I do not advocate compulsory arbitration of every labor controversy that arises in the country. I believe it would be wise to limit compulsory arbitration to those employments that are vital to the public at large; and with respect to railroads, I should limit it to disputes with men in the train service. Surely the public is entitled to have the operation of trains continue and to call upon trainmen and the railroad officers alike to invoke and submit their disputes to the judgment of some high class tribunal created by law to hear and decide such controversies, just as we are all required to submit to the judgment of public tribunals—the courts—controversies involving our property, our liberty and our lives.

Increase in Taxation

The next difficulty of the railroads I mentioned is the phenomenal increase in taxation. Unfortunately I have no remedy to suggest for this; and, therefore, I shall say but little about it. I feel, however, that no statement to this committee of the problems confronting the railroads of this country would be candid and true that failed to mention the great increase in taxation. The Union Pacific is, I suppose, fairly representative of other railroads in this particular. For the 10-year period ended June 30, 1916, the Union Pacific System's mileage increased 40 per cent, its operating revenue increased 38 per cent, its operating expenses increased 44 per cent, its taxes increased 157 per cent, and its operating income increased only 22 per cent. And its taxes are still rising, for the increased income tax, the capital stock tax, and the excess profits tax imposed by recent acts of Congress, call for additional taxes from this company running into hundreds of thousands of dollars yearly.

The cumulative effect of the various conditions I have described, upon the investing public, to which the railroad companies must look for the capital necessary to continue the development of transportation facilities, has been discouraging. For several years, certainly for the last five years, banks throughout the country have been overflowing with money—with uninvested capital. Call money rates have seldom been above two or two and one-half per cent, and often lower. Time loans for two, three and four months have generally been around three and four per cent in the money centers and places where money for railroad investment usually is to be found. Even the unprecedented industrial and commercial activity of the last year and a half or two years, which ordinarily would require so much money as to run up the rates, has not been sufficient to absorb the idle money or materially increase interest rates. Yet all this time high-grade railroad stocks, regularly paying good dividends for many years, were purchasable at prices yielding from 5½ to 7 per cent.

Of course, I do not wish to convey the impression that the strongest railroad companies have not been able to obtain capital for improvements. The strongest could obtain it, and probably will always be able to obtain it. But the average roads—the lines whose position is not yet so firmly established, or who have not such a large margin of financial safety—and certainly the weaker properties, are finding it increasingly difficult to obtain capital. Even the stronger lines, confronted with rapidly increasing expenses and fixed or diminished rates, and considerable uncertainty as to how they may be allowed to do their financing, have developed pronounced conservatism in all their plans.

Grant, for the purposes of this hearing, that, in some cases there has been "unwise railroad administration, not to say criminal railroad administration," as Mr. Thelen puts it. If it were not true, the railroad business would be the only business of any great magnitude in which there had not been "unwise" administration, and even "criminal administration." Please note, however, that, out of nearly a thousand railroad corporations in this country, Mr. Thelen cited only four examples of financial management which he found occasion to denounce, and of these the Chicago & Alton and Rock Island cases occurred some 17 years ago. There will be dishonesty and mismanagement in all lines of business and in all walks of life. But we cannot for that reason suspend business. We do not cease depositing our money in banks because there are now and then dishonest banks and bank failures. We must provide reasonable regulations to prevent as far as we can, and punish dishonesty and mismanagement. It would be folly to shape the railroad regulation of this country with reference to the Chicago & Alton case, the Frisco case, the Rock Island case, and the New Haven case. That is the trouble with most of the legislation we now have. It was designed to meet particular cases and to prevent certain conspicuous evils, and not for the regulation and building up of the most necessary transportation system in the world, and only as an incident, guarding against and punishing the evils therein. Surely we should not cripple and hamper the honest management of nearly all the railroad companies—99 per cent of them, at least—merely because there has been or again may be here and there a dishonest management.

The Causes of Impaired Credit

Mr. Thelen cited the cases mentioned, only as proof of the cause of impaired railroad credit, in opposition to our claim of too much conflicting state regulation, and it is that aspect of his contention, particularly, that I challenge. Investors know a great deal more about the merits of railroad securities than Mr. Thelen supposes. If you will refer to the quotations, as published in the papers any day, you will observe a wide range in prices of different railroad stock, showing that each is being very carefully gaged by buyers and sellers.

There may be investors, but I should say generally very few, who would be deterred by the Chicago & Alton, the Rock Island, the New Haven, or Frisco financing, and avoid railroad investments. But there are thousands of investors who could and would easily satisfy themselves that the securities were properly issued and free from the vices of those cases, and take all such securities, if that were the only danger. But those investors cannot satisfy themselves from the records of the commission, or otherwise, that the rates of the railroad company are not going to be reduced by some of the states, or held rigid by the Interstate Commerce Commission, nor that the company is not going to be hampered by some state commission in utilizing the resources to meet some great emergency, nor that the increasing expenses will not continue to soar from the coercion of unrestricted labor combinations, nor that the real operation and management of the property are not going to be dictated or controlled by the several state commissions, each perhaps with a different and rival policy, nor that there will not be practical confiscation under the system of so-called valuation, which is being carried out by the Interstate Commerce Commission with a theory of depreciation which makes it impossible for any railroad ever to be worth as much as it was the day it was built, nor that, with the ease with which it is being demonstrated a railroad can be subjected to all forms of taxation, emergency and otherwise, it will not be taxed to death. It is the inability of the investor to get any assurance against such dangers as these, which, in recent years, have become so imminent, that really turns him away from railroad investment.

But let us assume all that Commissioner Thelen's argument implies. Grant that all railroads are mismanaged financially, and consider the cases he cites merely as examples of many others. Will you leave the regulation of these evils to the states, where the evils have occurred? Or will Congress take hold of the subject in thorough fashion and enact a system of regulation, uniform throughout the country, that will effectually prevent fraudulent exploitation, and at the same time provide a simple and workable system under the direction of the Interstate Commerce Commission, without the conflict and confusion in the several state commissions that now exist? It was state charters and state laws and state functions that were exercised in the Alton case, the Rock Island case, the Frisco case and the New Haven case. The action criticised in those cases was taken by virtue of no act of Congress but under state laws alone. Instead of being brought up here in argument against full congressional legislation, they afford rather overwhelming reasons why Congress should exercise its power.

Whatever we may think of "watered stock," I do not believe there is fair room for doubt that the magnificent system of railroads of this country would not have been built without it. It was the speculative feature—the stock bonus thrown in with the bond bought—that attracted men and money to the support of the railroad enterprises. The "watered stock," that represented nothing but a gamble upon the settlement and growth of territory to be served, appealed to the gambling instinct so strong in human nature, and encouraged men to risk their fortunes in enterprises that would not have attracted or interested them merely as an investment. I am not defending "watered stock" and I am not condemning it. I am merely stating what I understand to be the facts, for the light they throw upon our problems of today. The regulation of the issue of railroad securities has come, and it has come to stay, and "watered stock" is practically impossible under such regulation. Our appeal in the future, therefore, must be to the investor whose conservatism demands safety and a certain and regular return upon his money. It is to these investors that we must look for the hundreds of millions of dollars that will be required every year to keep the transportation facilities abreast of the growth of the products and commerce of the country.

Commissioner Thelen cited the findings of the Interstate Commerce Commission that one cause of the insolvency of the Frisco was disproportionate capitalization, and declared his belief that this was one of the most potent causes of the financial difficulties of the railroads, and he argued to show that railroads raise money on bonds rather than stock. He did not tell you, however, how Frisco stockholders, or any other body of stockholders, could be induced or compelled to take additional stock at 100 cents on the dollar, if selling in the market at perhaps 50 cents or 25 cents. All the railroads of the country have stock outstanding, and probably the most of it is selling much below par. The laws of most, if not all, the states prohibit them from issuing and selling more stock for less than par. It is worse than idle to say that these companies shall raise capital by calling upon their stockholders to put up more money for more stock at par, when they can buy it in the market for very much less. The situation is a practical one, and such theories and suggestions take us nowhere.

There is, however, a feasible method by which the disproportionate capitalization may be diminished and stockholders enabled to put up more money in the future, and that is by abolishing the par value of stocks, so that additional stock of a company may be issued for what it is really worth. Take, for illustration, the stock of a corporation actually worth only 50 cents on the dollar. Of course, it is absurd to suppose that a stockholder will take more of it and pay 100 cents on the dollar. But he probably would be willing to take more of it at $50 a share, or at $40 a share, or at whatever the stockholders themselves might agree upon. It would be a matter wholly between the stockholders so long as they got a certificate only for what was actually paid into the treasury of the company, and not a certificate for $100 when paying only $40 or $50. A stockholder who took 1 or 10 or 100 shares at $50 a share would pay into the company $50, $500 or $5,000 in cash, and the company's capital would be increased by that amount. Its books would show that amount of increased capital, and nothing would be said about the value of the stock, par or otherwise. Stock watering would, in such case, be actually impossible. The stockholders would be enabled to come to the relief of their company, which it is impossible for them to do under existing state laws, requiring stock to have a par value, regardless of its real value, and forbidding the issue of stock for less than par. The first evil pointed out by the Interstate Commerce Commission in the Frisco case, and the "most potent" difficulty which Commissioner Thelen hopelessly leaves with you, would largely disappear. Of course, there will be companies whose assets are less than their indebtedness, or whose situation is such that they cannot expect to earn a return on the stock. In such cases, the stockholders naturally would not take more worthless stock at a substantial price. But there are many cases in which stockholders would assist the company by taking additional stock, where they cannot do so now.

Unification of Regulation

I come now to a consideration of the remedies which we have to suggest:

First, we believe that the unification of regulation is essential, and that, with the rapid increase of state commissions in recent years, Congress will in time be compelled to exercise its power in the premises. To unify regulation, there should be a complete, consistent, harmonious and related system of regulation. We believe the best, if not the only practicable method, is the federal incorporation of railroads by general law, which will make incorporation thereunder compulsory—thus imposing on all railroad companies throughout the United States the same corporate powers and restrictions with respect to their financial operations and the same duties and obligations to the public and the government with respect to their duties and obligations as common carriers—so that every investor will know precisely what every railroad corporation may and may not lawfully do in issuing and selling securities, and every shipper and traveler may know the duty and obligation of every railroad company to him, whether in Maine or California, in Michigan or Texas or in any state.

Congress may go as far as it likes in the regulation of the corporations created by it, and of the railroads owned by them. It may withdraw them entirely from regulation by the states, or it may permit regulation to such extent as it may prescribe. It is, of course, for Congress to say how far it will go. We believe that exclusive congressional regulation of the issue and sale of stock, bonds and other securities, of the rates to be charged for the transportation of passengers and property, and of all matters of transportation, is absolutely necessary in order to provide an adequate system of transportation for the country, and to check the growing fear that rapidly increasing state regulation will lead to conditions seriously impairing the service as well as the credit of the railroads. The most urgent feature, in my judgment, is the exclusive regulation by Congress of the issue of securities, with provision for the proper establishment, maintenance and financing of all interstate railroad systems without reference to the conflicting and peculiar, if not selfish, requirements of some one or more of the states traversed.

The consensus of opinion of the railroad executives who have been considering this matter was that the regulation of all matters essentially local and incidental, not impairing the service, and all matters of taxation should remain with the states, as at present. The corporation should not be entitled

to remove suits to the federal courts by reason of being a federal corporation.

Federal Incorporation

You may well ask whether it is necessary to federalize all railroad companies by requiring them to reincorporate under an act of Congress, in order to enable Congress to regulate their securities, their transportation charges and their service. My own opinion is that it is not. That is to say, I believe it would be practicable, with proper care, to draft a law by which Congress could regulate state corporations engaged in interstate railroad transportation in the particulars mentioned. But it is not clear that this could be done. I am sure, however, that the object could be accomplished more effectively, with less friction and confusion, and with better results to the public and everybody, by requiring federal incorporation.

With respect to existing corporations, Congress should require them to reincorporate by filing with the designated agency of the government articles of reincorporation, which should contain the statements and declarations Congress may prescribe, and thereupon they should become federal corporations instead of state corporations, and possess the powers which Congress by the act for reincorporation declares such corporations shall possess. The obligations to creditors and all other private rights and relations should continue as before, and the stock and the certificates representing it should remain as before until transfers are made in the usual manner, and, of course, the certificates would, in form as well as in fact, represent stock of the reincorporated company. Someone has discovered in this suggestion a scheme for validating invalid stock. Such would not and certainly need not be the effect, for it could be provided in the act that such reincorporation should not, as between the corporation and its stockholders and creditors, create any new rights or obligation or validate anything already invalid. In short, on a given day to be specified in the act of Congress, all railroad corporations of the United States would cease to be state corporations and would become federal corporations with the powers set forth in the act of Congress, and would thereafter be bound, with respect to all corporate powers and action, by the terms of such act, rather than by the various state statutes and special charters.

Federal incorporation, or complete federal regulation in any form, will, of course, add enormously to the work of commission supervision, and I have already pointed out that the Interstate Commerce Commission is even now hopelessly overburdened.

How is this problem of supervision to be solved? Railroad executives have thought of it a great deal. All realize that supervision has come to stay, and none would abolish it if he could. But how can it be made workable? There have been proposals that the membership of the commission be enlarged, and, indeed, that it be enlarged to such an extent that it may subdivide itself into several commissions sitting separately. We see no objection to the enlargement of the commission to such extent as Congress may deem advisable, but we believe it would be extremely unwise to attempt to solve the problem by having the commission divide itself into several sections. Suppose that instead of creating circuit courts of appeal, and other tribunals, the Supreme Court of the United States had been enlarged and divided into sections for the final decision of cases? Is it not certain that there would have been confusion and uncertainty, and a great loss of character for the court, and that it would not have attained that confidence, respect and esteem of the people which is now so universal?

Moreover, the Interstate Commerce Commission under existing law is clothed with different functions which are so inconsistent as to greatly impair its use to the country. It is charged with the duty of detection and punishment, and at the same time of hearing and deciding. In reorganizing the commission, we believe it would be wise to separate these inconsistent functions, which violate one of our fundamental principles of government, and that such separation will also lead to a better organization.

We believe that several commissions are necessary. The present Interstate Commerce Commission should be vested with the higher powers and duties arising under the Interstate Commerce act and other laws of Congress regulating commerce, such as the power of hearing and deciding complaints, and over the rates and the regulations of the carriers, and the issue of securities, and that the remaining duties, such as inspection, detection, prosecution and correction, safety appliance requirements, statistics, etc., should be conferred upon a new commission with some other name—for instance, "Federal Railroad Commission." But in order to co-ordinate and harmonize the system of regulation, the Interstate Commerce Commission should have the right, but should not be required, to review any action of the additional commission.

We also believe that regional commissions should be established to assist the Interstate Commerce Commission in exercising its jurisdiction, and to that end should make all such investigations, and hear and determine all such complaints, and perform such other duties as the higher commission shall direct. The orders of the regional commission should not become effective until approved by the Interstate Commerce Commission, but should stand approved as of course, unless excepted to at a time to be limited—somewhat analagous to the practice with respect to masters in chancery.

The reorganization of the commission along such lines would, in our judgment, provide a sufficient number of intelligent and able agencies for the prompt decision of all questions, and quick performance of all the duties devolving upon the commission under the law, and avoid those long delays that are so hurtful in the decision of commercial matters.

Government regulation of rates and securities carries with it certain governmental responsibility. So long as the railroads made their own rates and did their financing without restriction, the public were justified in looking to railroad men for adequate railroad transportation. But when the government fixes the rates and limits the income and restricts the borrowing power, it takes over the railroads' responsibility to provide transportation facilities, except to the extent and within the limits of the means allowed by the regulations imposed. There is obviously a duty to keep the railroad transportation of this nation abreast of the daily increasing requirements of the people. That duty, I respectfully submit, is shared by Congress to a very much greater degree than, with all deference, I believe Congress realizes. Unless Congress performs its duty under the Constitution and releases the shackles that have been and are being forged by the states, railroad development must necessarily become slower, and fail to keep pace with the growth of commerce and the needs of the people. Having exercised the power of regulation, and permitted its exercise by the states, Congress must go forward with it and provide a *workable* system of regulation. It may defer for a short time, but it cannot avoid the problem. The denunciation of improvement or dishonest railroad financing, portrayal of the mistakes and the wrongs of the past, and innuendoes and insinuations respecting the hidden purposes or motives of railroad executives, are not going to solve the problem or provide adequate railroad facilities. It is, I submit, the duty of Congress, if not to provide, at least to pass laws that will permit the railroad men to provide sufficient railroad facilities. They cannot do it under the existing system of regulation to the full extent required by the country's needs.

For a country such as ours, for a people situated as we are, dependent upon our railroad systems for our daily bread, to blunder along with a series of unrelated, inconsistent, conflicting statutes enacted by different states without relation

to each other, instead of providing a complete and carefully studied and prepared system of regulation for a business that is so vital to the life of the nation is worse than folly.

Senator Charles E. Townsend of Michigan has been appointed a member of the Joint Committee on Interstate Commerce, succeeding Senator Brandegee of New Hampshire, who has retired from the Senate Committee on Interstate Commerce.

AN ELABORATE STUDY OF TRANSVERSE FISSURES

A westbound passenger train on the Galveston, Harrisburg & San Antonio was derailed by a broken rail near Iser, Tex., at 10:41 p. m., January 31, 1916, while traveling at a speed of 40 miles an hour, resulting in the injury of five passengers and one employee. This train consisted of seven cars and was derailed on tangent track on a slight ascending grade. The track was laid with 33 ft. 80 lb. rails rolled in 1904 and laid in February of the following year on 20 ties per panel with about 15 in. of slag ballast. The initial break in the rail was about two feet from the receiving end, while the next section of 12 ft. 6 in. was broken into 11 pieces. These breaks showed transverse fissures clearly. Because of this James E. Howard, engineer-physicist of the Interstate Commerce Commission, made a detailed study of the fissures in the rail and of the entire subject of transverse fissures as illustrated by this accident. The following is abstracted from his report:

In the subsequent examination of this rail seven additional transverse fissures were revealed, making 15 in all. These fissures ranged in size from 0.30 in. in diameter to 1½ in. by 1 in. Thirteen were located on the gage side of the head, or central over the web, and two were in the outer half of the head.

Chemical analyses of the rail showed a high phosphorus content, notwithstanding which the bending tests of the steel in parts of the rail remote from the zone in which transverse fissures were displayed gave favorable results. Drillings for chemical analyses were taken from the top of the head, from the location of the nuclei of the transverse fissures and at the junction of the head and the web. Neither these chemical analyses nor microscopic examination showed any specific cause for the development of transverse fissures.

Believing that the subject of transverse fissures in rails is one of such importance that supplementary data were to be desired, Mr. Howard undertook a series of extensive tests. One of these tests consisted in subjecting different sections of a new 100-lb. rail to wheel loads of 35,000, 25,000 and 15,000 lb. respectively in a reciprocating machine. These rail sections were passed back and forth under the loaded wheel after which they were examined to ascertain the interior strains developed. In this examination it was shown that the internal strains in the metal on the gage sides of the rail were much above those in the outer side of the head, the latter being almost negligible, leaving no doubt concerning the augmentation of internal strains in the top of the rail by wheel pressures.

A study was also made on the effect of gagging on the creation of internal strains. A series of observations were made upon high carbon and low carbon 100-lb. rails subjected to normal and to excessive gagging upon the head and upon the base and to a 10-ft. drop test on the head and on the base. As a result of these tests the conclusion was reached that neither the gagging in the normal nor the excessive amount on the head or the base, or the more severe ordeal of the drop test, had appreciably affected the microstructure of either grade of steel.

Gagging may, however, be conducted after the manner of fatigue tests and ultimately cause a rupture of the rail. To do this a large number of repetitions are necessary, but interior transverse fissures may be developed in this way at will in rails and they were so developed in 24 new rails. Not only was it possible to produce interior transverse fissures by means of progressive gagging in new rails but it was also demonstrated that control could be exercised over the position of the nucleus of the transverse fissure within the head of the rail. Central vertical loadings produced a transverse fissure in the middle of the width of the head. By inclining the rail and applying the load at one side of the head a transverse fissure was produced on the side of the head which was loaded and could be produced on either side according to the loading. In connection with the laboratory development of transverse fissures and the control exercised over their position in the heads of the rails, a group of 663 rails which displayed transverse fissures were studied, in 535 of which the fissures were on the gage side of the rail while 128 were centrally located and none were on the outside of the rail.

As a result of these studies it was concluded that the length of time that a rail is in the track is not in itself the controlling factor in the development of transverse fissures. Fractures of this type have been displayed in rails after a few months in the track and in others which have been in service from 10 to 20 years. The life of steel under repeated stresses is not measured by lapse of time but in terms of the maximum stresses and the number of times which the stresses are applied. According to the weight of equipment and the density of traffic, this may be accomplished in rails within a few months or may require a term of years.

The reheating of blooms was also considered, and photographs were shown of transverse fissures which were developed in rails of 125-lb. section after a short term of service in the track. The metal in these rails had a generally uniform structure but the fact that they occurred in reheated blooms indicates that this alone is not a preventive of transverse fissures.

The development of a transverse fissure presents a type of failure which has the characteristics of a fatigue fracture. A fatigue fracture is one which results from the repetition of loads too great for the steel to long endure. It is a progressive fracture in its usual development, one to which the name "detail fracture" is often applied. It is gradual in its development chiefly when the loads which cause it are variable. It is a tension fracture, and occurs where the tensile stresses reach a maximum.

In a rail, the greatest tension in the head is along certain interior elements by reason of the initial strains of compression set up at the running surface by the cold rolling by the wheels. The location of the metal in maximum tension accounts for the interior origin of transverse fissures. Its interior formation is a distinguishing feature over other fatigue fractures where the compressive component is not present.

Incipient fissures are found at frequent intervals along the interior elements of the head in rails which have failed in this manner. The same is true in fatigue fractures made in the laboratory. The integrity of the steel is destroyed locally and fine checks appear on the surface of the bars when they are subjected to direct tensile stresses, after failure under repeated loads.

Experimentally, transverse fissures have been made in new rails, where control over their location in the head has been demonstrated. They were located at will, centrally over the web, and on the right side or the left side of the head, according to that on which the load was applied.

Neither chemical analyses nor microscopic examinations have shown a definite cause for the development of transverse fissures. They have occurred in rails of different weights; in those of different ingot positions; in the product of each of the two great methods of steel making, Bessemer and open-hearth; in direct-rolled rails and in those from

reheated blooms; in rails laid on curves and in those on tangent track; over ties and between them; they have made their appearance in the different seasons of the year, and in rails rolled in the different seasons; they occur where, according to chance, the rails may have been gagged and from the number and proximity of the fissures, where they probably were not gagged; they have displayed themselves singly, and independent of other types of rupture, and also associated with shearing fractures or seams which have developed in planes at right angles to the fissures; they are found in the head and not in the base of the rail; they appear in rails which show very little wear; they are not confined to any one rail mill, nor to northern or southern mills, nor to any one year's rolling, but have been displayed by rails rolled at periods of time separated by not less than two decades. The latter fact should remove doubts concerning any peculiar conditions having found their way into modern mill practice influencing this type of failure.

On the other hand, traffic has increased, wheel loads have increased, and speeds have increased; and transverse fissures are in general found where these conditions are well advanced. The girder strength of the rails has been increased, while the impinging pressures of the wheels still remain without amelioration. It is a disquieting matter that rails of the heavier sections recently laid have displayed transverse fissures. Mere increase in weight of section has not brought with it immunity from failure in this manner. It gives emphasis to the need of acquiring further data upon the features which have been discussed in this report.

The conclusion seems well founded that transverse fissures are fatigue fractures, and that they develop in rails which are structurally and chemically free from any known defect. It is a modified type of fatigue fracture in which there is a compressive component in the rail next the running surface of the head. The presence of this compressive component accounts for the interior origin of the transverse fissure. It constitutes the difference which the introduction of the term "transverse fissure" was intended to emphasize over the common type of fatigue fracture in which this component is absent and which in consequence thereof has an exterior origin.

TAKE EMPLOYEES INTO YOUR CONFIDENCE*

By John Duffy

Advertising Agent of the Lehigh Valley Railroad

Whether you are a railroad man or engaged in commercial pursuits, much of the success of your company depends upon the position in which you can place your company before the public. The greatest mistake of a manufacturer or a railroad is to leave employees who are meeting the public in doubt as to the company's policy. If these employees are not to be trusted they have no business on the payroll. The management must take its employees into its confidence if it wishes to make them friendship-winners for the company. From time to time, on the best regulated railroads, unpleasant incidents will appear, which must see the light of day in newspapers. Seeking to suppress stories of this kind gains only discredit for the whole organization. On the Lehigh Valley no time is lost getting in touch with press associations and the local papers and telling them the whole story. There is no suppression of details—on the contrary, we seek to aid the newspapers in getting an accurate report. The fact that we are known to tell the truth in a matter of this sort gains a general confidence in other statements.

We are about to issue a set of instructions to our freight and passenger men [here follow extracts]:

"When we sell a ticket we sell more than a ride.

"When we issue a bill of lading our obligation extends beyond the mere movement of freight.

"In each case our patrons are entitled to and must receive prompt, courteous and accurate information and attention.

"To Passenger Representatives:

"If a train is late, say so.

"If you don't know how late it is, find out.

"Do not tell passengers Pullman space is unavailable until you are sure other stations cannot release space to you.

"Passengers have a right to criticize a railroad service. Criticism is frequently the basis of improvement.

"To Trainmen:

"You are the official hosts of the company. Make the passengers feel they are at home on one trip and they will be with you on their next. This is more than good business policy. It is a manly . . . policy. It is the only policy.

"To Freight Representatives:

"Accepting freight is but the beginning of our service to a shipper.

"When he asks for information about that freight he is exercising a right—not seeking a favor.

"Don't promise a shipper to place a car today if you know it cannot be placed until tomorrow.

"Help the shipper to hold his customers and you will help us to hold the shipper as a customer. . . ."

*From an address before the Newark, N. J., Traffic Club.

EXPEDITING SHIPMENTS OF COMPANY MATERIAL

The committee on "Conservation of Equipment" of the Railway Storekeepers' Association has prepared a report which will be presented to the association at its convention in May, but appreciating the importance of this subject to the railways at this time, the executive committee of the association has released the report for immediate publication. An abstract is given below:

The unusual demand for equipment, together with insufficient terminal facilities, both for commercial and company material, has forced the store department to give a large part of its time to releasing cars. It has invented ways of handling material, which not only release cars more promptly, but also reduce the cost. The subject of conservation of equipment naturally divides itself into six heads: (1) prompt switching, (2) prompt releasing, (3) prompt loading, (4) proper routing and prompt handling enroute, (5) prompt handling of material for repairs to equipment, and (6) co-operation.

Prompt Switching

To obtain prompt switching, it is necessary to know what the car contains, where it goes, and the best time and way to move it to its destination. It has been found of great help to have the shipper send the shipping notice or invoice in time to reach the storekeeper at least 24 hr. before the car arrives. This information should be given to the general foreman or other individual who makes out the switch list. The latter is of enough importance to be made out by the general foreman and approved by the storekeeper. The switch list should be given the yardmaster in sufficient time to enable him to plan his work properly.

Cars that are reconsigned should be moved from the holding yard to the train. Often they can be moved in the train in which they came without any switching or delay. Whenever possible, the holding yard should be checked before the switch list is made to move the cars with a minimum of switching. Good head work in lining up the cars will save much switching. This cannot be done by switchmen, but must be attended to by one familiar with the contents of the cars and their proper disposal.

Switching must be efficient if equipment is to be conserved, and to insure prompt service the storekeeper should be prepared to give arguments that will convince the operating officers of this fact. A special switch engine should be assigned exclusively to storehouse work whenever it is justified.

Prompt Release of Equipment

The prompt release of equipment requires competent supervision, efficient help, adequate facilities and reports.

Competent supervision can be obtained only by proper training and sufficient pay to make the positions desirable. Unless the help and facilities are properly guided, there is sure to be delay in releasing equipment.

Efficient help is absolutely necessary. In releasing cars it is not only necessary to handle the facilities economically and rapidly, and unload the material quickly, but it is far more important to have the material stored so that it is available for use when wanted, and for a check for reordering when necessary to replenish stock. If material is not properly stored, the consequent loss in the use of the equipment because of missing repair parts far exceeds any extra cost in proper storing. Efficient help can only be had with competent supervision and sufficient pay to make the work attractive. It requires a much higher grade of labor to handle material properly than it does to do track work, or labor work around the shops. A laborer in the store department must know the difference between an eccentric and a smoke stack, and thousands of other items. It also requires much skill and strength properly to unload, store, pack, etc., all the kinds, weights and sizes of material. Piece work gives increased output with decreased cost, and it is an important item in promptly releasing and loading cars.

In these times of scarcity of labor, mechanical facilities are not only necessary to reduce the cost of handling material in releasing cars, but they are absolutely necessary to get them released at all. The committee has found that all of the following mechanical devices are being used to good advantage, and recommends their use whenever and wherever possible:

Overhead crane equipment with magnets for casting platforms and scrap docks; locomotive cranes equipped with magnets for scrap dock, lumber and material yards; hand cranes for casting platforms, oil houses, etc.; gravity rolls for lumber yards, iron yards, etc.; belt conveyors for salt, sand, etc.; gravity chutes for cement sheds, coal bins, scrap dock, etc.; stackers for cement and packages; monorails for side rods, heavy castings, etc.; electric trucks with trailers for distributing material from cars to storage places; gasoline trucks for taking material to storage places from cars; ball bearing elevated trucks for handling material from cars to storage places; hand trucks and other patent trucks; brick tongs; pumps of sufficient capacity to release tank cars quickly; skip hoists for ice, etc., and rubble cars of special design to carry certain kinds of material.

Reports should be made of cars on hand and released each 24 hours, and each week or oftener a summarized report should be sent to the general storekeeper and checked by him to see that equipment has been properly handled. Every effort should be made to release cars the day they are set, and overtime worked when necessary to avoid carrying cars overnight. This not only gives the use of a car for 24 hr., but very often prevents congestion in the storage yard and facilitates the work the next day.

Prompt Loading

The committee finds that sufficient attention has not been given to loading cars promptly. To conserve equipment it is just as necessary to load a car promptly as it is to release it. Cars should be loaded to capacity whenever possible, and special attention should be given this by the supervisor.

A number of railroads have worked out a plan for handling scrap that conserves a large number of cars. At each shop or plant where scrap is accumulated, the larger scrap, such as flues, pipe, cast iron, couplers, steel and iron forgings, etc., is classified, loaded in carload lots where the quantity is sufficient and sold direct. This saves a car from the loading plant to the scrap dock. When there is not a sufficient quantity for a carload, the different classifications are loaded separately in the same car and billed to the scrap dock. There it is unloaded direct to the storage bin with a magnet. This leaves only the small scrap that the originating points cannot classify, which is a small percentage of the total, to be loaded alone and unloaded in the sorting bin.

Special attention should be given to seeing that equipment best suited for the material to be loaded is provided; for instance, wheels, axles, or large castings should not be loaded in high side coal cars to points that have no derricks for unloading. Material on the line should not be loaded and sent to the storekeeper when there is no demand for it.

It is often found advisable to joint-load cars and bill to the first station, where the material for that station is taken out and the car then reconsigned to the next station. Great care should be exercised in doing this, as it is very easy to take up more time for equipment in joint loading than in direct loading. Material for use out on the road, where a large gang is working, should be loaded out in quantities sufficient to make a work train economical, and the material should also be shipped to where the gang is to avoid using the cars for storage.

Coal can be stored where it is to be used in the summer time, and handled with clam shells in the winter time when coal equipment is in demand. This same practice can be worked with other equipment and material or supplies, if there is proper co-operation.

It has been found that mixed carloads of lumber and iron can be unloaded much more rapidly by unloading them in a sorting yard, sorting lumber in sizes, picking it up with the derrick and carrying it to the place where it is to be stored. This saves holding the car and switching it up and down the track while the sorting is being done.

Shipping boxes for loading pipe fittings, nuts, small bolts, etc., save space in equipment. These boxes are about 12 in. by 24 in. by 12 in. deep, and have adjustable partitions. They are easily packed, quickly unloaded, and it is easy to put the material in its proper storage place, as there is no chance for the material to become mixed in these boxes.

Handling Material for Repairs to Equipment

It is very important in conserving equipment to have repair parts on hand for repairs at all times. To do this, it will be necessary to increase the stock carried materially, with a consequent increase in the money tied up in material. A report should be given to the storekeeper and the general storekeeper each day on equipment held at all points for repair parts, together with a description of the material for which the equipment is held. Every effort should be made to supply the material in the least possible time.

Co-operation

Co-operation of all departments is very necessary in conserving equipment. By co-operation, material can be shipped direct to where it is to be used, and where there is sufficient force to handle it. Often when the right kind of material is not available, on account of slow deliveries, etc., substitutions could be made if the proper spirit is displayed. The user of material should consult the store department as to the material available, and the store department should consult the user, so as to give him service when needed. The committee finds that there has been complaint of delay in furnishing material for cars held up for repairs on foreign roads. The shipment of material is often held up in the freight congestion. The handling of material of this nature should be expedited, and where it is not too heavy, sent by express. Special attention should be given this subject by the storekeepers, to see that there is no delay in shipments of material, and that it is properly routed.

The report is signed by the following committee: D. C. Curtis, C. B. & Q., Chairman; W. Davidson, I. C.; C. B. Cherry, P. R. R.; W. A. Linn, C. M. & St. P.; J. C. Kirk, C. R. I. & P.

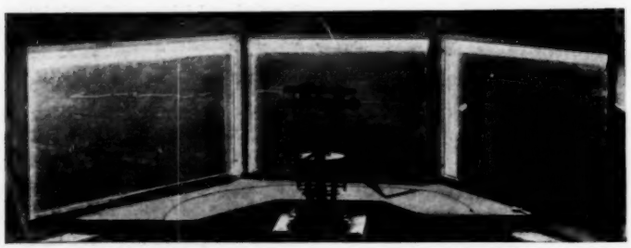
A Section of the Sheds in the Winter

Protecting a Line from Snow Troubles

The Southern Pacific Maintains Over 29 Miles of Sheds and Other Precautions to Insure Continuous Operation

THE Southern Pacific has built and maintains 155,146 lineal feet (29.37 miles) of timber snow sheds of which 9 miles is for double track in a distance of 29½ miles at the crossing of the Sierra Nevada mountains on its line between Ogden and San Francisco. These sheds, which involve an annual maintenance cost of $150,000 and a cost to reproduce of about $3,000,000, have been provided to keep the track clear of drifting snow and to insure continuous operation on this important line during all seasons of the year. The sheds are located on the heavy grades on both slopes of the mountains.

Operation through snow sheds for a distance as long as



The Transit in the Observatory Window

this presents a number of interesting problems. Electric signals specially designed for use in the snow sheds and under the control of operators are employed to indicate to approaching trains whether they are to proceed on the main track or to enter the side track. These signals are so interlocked that one train cannot receive an indication to pass the initial switch on the main track if this section is already occupied by a train.

All switches within the sheds are fully equipped with lights which burn continuously. The distance from the switches is also indicated in car lengths by painted signs on posts at the side of the track to enable engineers leaving a passing track to determine when the rear of the train has cleared the switch.

Tests of the train line and signal hose are made at frequent intervals while passing through these sheds and over the heavy grades. All stations are connected by telephone to afford facilities for quick communication in the event of a runaway car, train or other accident so that the proper measures may be taken promptly. The sheds are provided with chimneys to permit the smoke and steam to escape promptly in the vicinity of the signals. Particular care is also taken to keep the signals from being obscured by snow and ice.

The staff system is used in conjunction with the automatic signals in the snow shed territory where dependence on train orders and automatic signals would be cumbersome and difficult. For this purpose this portion of the line is divided into blocks approximately three miles in length with an office and a side track at the end of each block. Each office is provided with staff machines electrically connected and interlocked so that when one staff is taken out of a machine it locks both machines in that block and another one cannot be obtained from either end until the first one has been returned to a machine at one end of the block. In order that one staff may be dropped and another one picked up without unnecessary loss of time a special crane known as the Keefe Time Saving Device has been provided. An important advantage of the staff system for use under these conditions is the fact that a train finding any part of the sheds afire may immediately back up to the station in the rear without delay or danger or the necessity of sending a flagman out to protect against a following train.

In addition to the installation of this large mileage of snow sheds, rotary snow plows, headlight snow plows, flangers and spreaders are maintained on this section of the line. This equipment is thoroughly overhauled during each summer and is fired up and given a trial run shortly before the snow flies in the winter to insure that it is in working order.

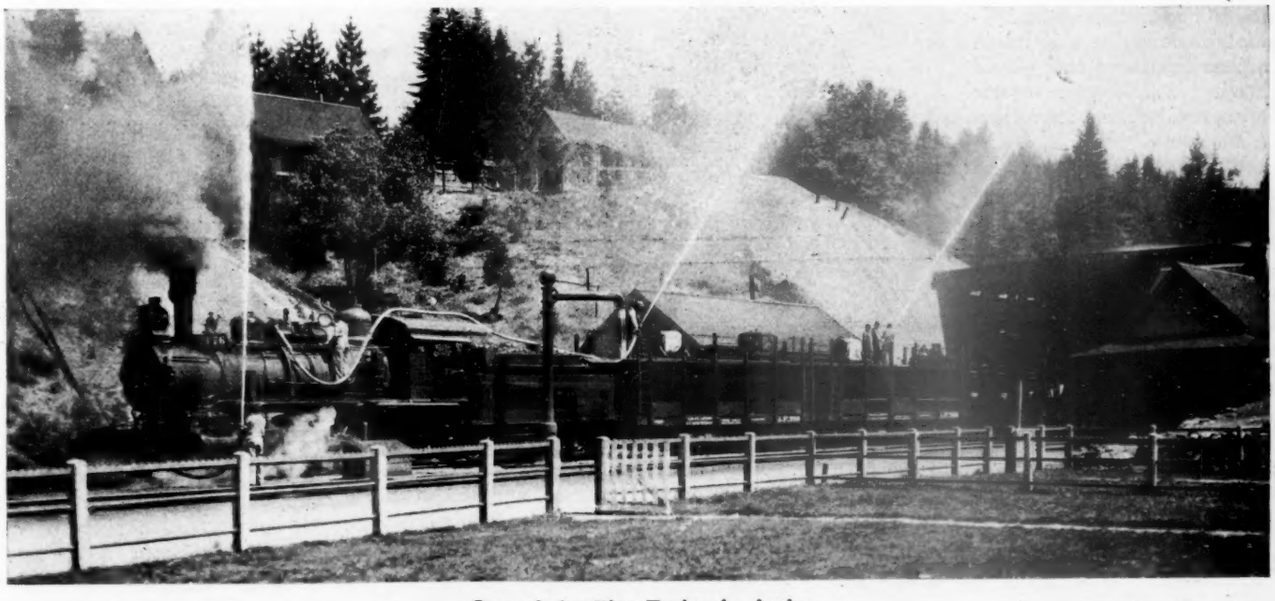
The Fire Protection System

The protection of this extensive mileage of sheds from fire, has received particular attention since these sheds are located in a heavily timbered section where the camp fires of sheep and cattle men as well as of hunters and campers frequently start brush and forest fires. Special rules are enforced regarding the use of fusees so that the possibilities of fire from that source are remote. All brush and combustible materials are also removed from proximity to the sheds. As an additional precaution telescopic sections are introduced into the sheds at frequent intervals in order to provide gaps across which a fire would not cross ordinarily. These sections consist of portions of the shed 100 ft. in length mounted on wheels or rollers and running on tracks parallel with the axis of the shed. In the summer they are run back into the enlarged portions of the adjoining sheds, leaving a clear interval of 100 ft.

An elaborate patrol system is maintained for the detection of fires promptly and watchmen are required to turn in signals to a central point at frequent intervals. Owing to the mountainous country in which the sheds are located and the fact that the slopes are covered with timber, the problem of detecting fires quickly is a difficult one. Two complete separate fire alarm systems are maintained. One of these is a central office system, with the office located in a reinforced concrete building at Summit station and with boxes at each mile post throughout the length of the sheds. These boxes are used the same as in a watchman's detective system as well as for the sending in of alarms. The second system consists of regular fire alarm boxes directly connected to alarm gongs at the fire train stations. These boxes are located at points between the district boxes and are used for fire alarms only. Special watchmen are also located at particularly vulnerable points or where for any reason the sheds are not in clear view from the main lookout station. These men are located either on top of or close to the sheds and send in alarms over the district system to the central office. All watchmen are required to report hourly either by telephone or by the district alarm system.

In addition to the two systems already referred to an observatory is maintained on a prominent mountain peak on the west slope of the Sierra Nevada mountains, known as Red Mountain or Signal Peak, the summit of which is 7,860 ft. above sea level or about 2,000 ft. above the sheds at the nearest point. The value of this peak as a watchmen's station was recognized as early as 1876 and the development of the telephone made it possible to utilize this for that purpose, watchmen being stationed at this point since that date. From this observatory, which is a solid stone building, an unobstructed view is had of practically all of the sheds west of Summit. A transit is mounted on a solid pier in the large front windows of the observatory with a map of the sheds in front of it, fastened on a silver-plated copper plate over which swings a knife blade pointer attached to and coinciding with the axis of the transit. On this map is located every station, tunnel, bridge, mile post, signal box and shed opening. As the shed itself cannot be seen at night a line has been etched on the plate glass of the window coinciding with the actual line of the shed as seen from the transit and the location of a fire in relation to the sheds can be deter-

View of the Tracks from the Observatory



One of the Fire Trains in Action

mined by the apparent location with reference to this line, while the particular part of the shed threatened can be ascertained more definitely from the location of the pointer over the horizontal map.

In addition to detecting actual fires which threaten timber lands, snow sheds or other railroad property, the watchmen in this observatory observe campers and others closely. When fires are built in proximity to the sheds word is telephoned to the nearest section headquarters and men are sent out from there to move the parties a safe distance from the sheds and to extinguish the fires. In case of an actual fire an alarm is sent in over the telephone. While the Southern Pacific maintains this lookout station at its own expense it co-operates with the forestry department in detecting and handling forest fires.

A less elaborate but similar station is maintained at a point over the Summit tunnel from which most of the sheds east of the Summit are visible. This station is connected directly by telephone with the Central office at Summit. To extinguish fires four fully-equipped fire trains are maintained, each consisting of a locomotive and two water cars. One is stationed at each end of the shed district and the remaining two at intermediate points in the shed. Steam is carried at all times and the crew is always on duty. Each engine carries a duplex fire pump capable of furnishing two good size streams and an inspirator which will furnish another stream. With the 1,000 ft. of standard 2½-in. hose on each train and an average water supply of about 18,000 gal. means are provided for controlling a considerable fire.

All timber lands owned by the Southern Pacific in this vicinity are also thoroughly patrolled by employees who devote their entire time to this work. These employees receive appointments as deputy state fire wardens and co-operate with the state boards of forestry, the fire associations and the property owners in effectively patrolling timber lands.

The average number of alarms responded to by the fire trains during the past four years has been 18. Any one of these alarms would have probably resulted in serious damage to the sheds and consequent danger of interrupting traffic had not this thorough system of protection been maintained. This protection costs approximately $50,000 per year. We are indebted to W. R. Scott, vice-president and general manager of the Southern Pacific for the data contained in the above article.

EARLY USE OF SPRINGS ON RAILWAYS.—According to the Engineer, London, the first record of the use of springs on railways is George Stephenson's patent of September, 1816. The first locomotive with steel springs was the Agenoria, built by Foster and Rastrick in 1820, and now in South Kensington Museum. This had laminated springs on the leading wheels.

HENRY C. HALL

In accordance with the usual custom of the Interstate Commerce Commission of selecting its chairman by rotation of its members in the order of seniority, Commissioner Henry C. Hall has been elected chairman of the commission for the period of one year beginning on March 17, at the expiration of the chairmanship of Commissioner Meyer. Chairman Hall has been a member of the Interstate Commerce Commission since January, 1914, when he was appointed by President Wilson to fill the unexpired term of Commissioner Charles A. Prouty, who resigned at that time to become director of the division of valuation. Subsequently Mr. Hall was reappointed by the President for the full term of seven years.

Mr. Hall was graduated from Amherst College in 1881 and from Columbia Law School in 1883. From 1885 to 1892 he was engaged in the practice of private and international law in Paris, France, and for the last four years of that period was counsel to the United States Legation. He removed to Colorado Springs, Colo., in 1892 and there engaged in the general practice of law. He was general counsel of Colorado College, of the Arkansas, Louisiana & Gulf Railway and of many corporations. He served as district attorney for the fourth judicial district and city attorney for Colorado Springs; and from 1905 to 1907 was mayor of that city. He was also lecturer on law at Colorado College. In 1911 he was elected president of the Colorado State Bar Association, and the following year was elected vice-president for Colorado of the American Bar Association.

H. C. Hall

During the three years that Mr. Hall has been a member of the Interstate Commerce Commission the Division of inquiry, which has charge of the enforcement of the penal provisions of the act, and the Division of Law, which has charge of civil actions in which orders of the commission are contested in the courts, have been under his immediate direction. Commissioner Hall has done very little during his service on the commission to make himself personally conspicuous and has delivered few public addresses to indicate his personal opinions. He was among the majority of the commissioners who voted against an increase in freight rates for the eastern carriers in the original five-per-cent rate case in 1914 and he was also among the majority who decided in favor of an increase in the supplemental decision of the commission in that case in December, 1914. During hearings before the commission he manifests a keen interest in and close attention to the questions under discussion and asks many questions which go direct to the heart of the problem under consideration indicating a comprehensive understanding of the points involved.

NEW RAILWAY IN ECUADOR.—A new railway is about to be constructed in Ecuador, from the city of Chone to Quito.

Railroad Managers Grant Demands of Trainmen

Strike Averted Without Waiting for Supreme Court Decision. Ten Hours Pay for Eight Hours Work

THE strike of the four brotherhoods of railroad trainmen which was called for seven o'clock Saturday evening was postponed for 48 hours pending conferences between a committee of the National Council of Defense appointed by President Wilson, the brotherhood leaders and the railroad managers, and late on Sunday night the demands of the brotherhoods were granted and the strike called off. The managers agreed to pay the men on the basis of eight hours instead of ten hours whether or not the Supreme Court upheld the Adamson eight hour law. On Monday the Supreme Court upheld the law in a decision printed elsewhere in this issue.

Council of National Defense Intervenes

No action was taken by the President to intervene in the situation until after the conference in New York on Thursday between the National Conference Committee of the Railways and the officers and committee representing the brotherhoods. From a sick-bed President Wilson had kept in touch with developments through his cabinet officers, and W. L. Chambers, chairman of the United States Board of Mediation and Conciliation. On Friday, after hearing that the railroad committee had rejected the demands of the brotherhoods and that the latter had rejected all proposals for arbitration, he called a meeting of the cabinet, at which it was decided to adopt a plan recommended by the Council of National Defense for sending a committee to New York, composed of two cabinet officers, Secretary Lane and Secretary Wilson, who are members of the Council of National Defense, and Daniel Willard and Samuel Gompers, who are chairmen of the committees on transportation and on labor, respectively, of the Advisory Commission of the Council. After the cabinet meeting Secretary of War Baker, who is chairman of the Council, made public the following letter of instructions to the committee:

"At a meeting of the Council of National Defense it was resolved that you be requested at once to seek an interview with the representatives of the railroad brotherhoods and the railroads, regarding the differences existing between them and apparently threatening to produce a general railroad strike throughout the country; that you present to the representatives of both sides the grave peril involved in the situation at this time and that you request them so to adjust their differences as in any event to lead to a postponement of any acute difficulty during the present national emergency."

The members of the committee, except Mr. Gompers, proceeded to that city at once and began conferences with the railroad and brotherhood committees. President Wilson also telegraphed to Elisha Lee and the brotherhood executives the following personal appeal:

"I deem it my duty and right to appeal to you in this time of national peril to open again the questions at issue between the railroads and their operatives with a view to accommodation or settlement.

"With my approval a committee of the Council of National Defense is about to seek a conference with you with that end in view.

"A general interruption of the railway traffic of the country at this time would entail a danger to the nation against which I have the right to enter my most solemn and earnest protest.

"It is now the duty of every patriotic man to bring matters of this sort to immediate accommodation. The safety of the country against manifest perils affecting its own peace and the peace of the whole world makes accommodation absolutely imperative and seems to me to render any other choice or action inconceivable."

The National Conference Committee immediately replied to the President's telegram as follows: "In harmony with the spirit of your message, the National Conference Committee of the Railways will co-operate with the committee of the Council of National Defense in an earnest effort to avert the national calamity which would result from an interruption of railroad traffic." No reply was received from the brotherhoods.

It was also announced in Washington that the office of the attorney general and of the judge advocate general of the army were looking up the law with reference to the power of the President to compel the operation of the railroads. Senator Newlands, chairman of the Senate Committee on Interstate Commerce, who had endeavored to secure the passage of a law giving the President specific authority to take over the railroads for military purposes and to draft into service both officers and employees at their usual compensation, expressed the opinion that the President's powers were so broad that they might well include the operation of the roads by executive order.

Many telegrams were received by the President from commercial and civic associations asking him to make every effort to prevent a strike until after the Supreme Court has decided the Adamson law case. Colonel George Pope, president of the National Association of Manufacturers, expressed regret that Congress did not adopt the President's recommendations to prevent the recurrence of such a menace and suggested that the controversy be submitted to the Interstate Commerce Commission or a special commission to be appointed by the President. William Fellowes Morgan, president of the New York Merchants' Association, urged the President to exert his influence to persuade or oblige both sides to maintain the status quo until the Supreme Court decision is rendered. The directors of the Illinois Manufacturers' Association sent resolutions setting forth that it would not be fair for one-third of one per cent of the workers of the country to paralyze industry. Telegrams were also sent by the Detroit Chamber of Commerce.

Governor Cox of Ohio telegraphed the text of a proclamation he had issued declaring his intention to operate the railroads of the state under martial law if necessary.

The Commission on Car Service of the American Railway Association considered issuing a notice to all roads regarding the placing of embargoes, but decided to take no further action in view of the recommendations it had recently sent to all roads that food supplies and shipments for the government be exempted in issuing general embargoes.

A Forty-Eight Hour Truce

The Conciliation Council went into session with the brotherhood leaders at 9:30 o'clock Friday night. They adjourned, after conference, with both the labor leaders and the railroad managers, at 3:45 o'clock Saturday morning. At 10 o'clock the conferences started again and were continuous until 3:30 o'clock Saturday afternoon, when Secretary Lane sent word to the newspaper men waiting that there would be a statement in a few moments. At 3:45 o'clock he issued the following statement from the conference room on the second floor of the Biltmore:

At our request and out of appreciation of the national situation, the brotherhoods and the railroad managers have resumed negotiations; and in the hope that some adjustment may be had that will avoid the necessity for

a strike the brotherhoods have wired or telephoned their General Chairmen asking that all action be postponed for 48 hours, and unless prior to that time advised of a settlement the men will leave the service, under the authority already given.

DANIEL WILLARD,
F. K. LANE,
W. B. WILSON.

Secretary Lane announced that conferences with both sides would be resumed at 10 o'clock Sunday morning.

Conferences were held all day Sunday and on Sunday night the Conciliation Council went into final conference with the managers, the brotherhood chiefs having refused absolutely to make any concessions or to postpone the strike order.

At 2:30 o'clock on Monday morning Secretary Lane issued this statement:

"Regardless of the decision of the Supreme Court on the Adamson law the basic eight-hour day will go into effect. The details are being worked upon by a joint committee, which will have its negotiations completed by noon."

He then gave out the following letter from the railway managers:

March 19, 1917.

Hon. Franklin K. Lane, Hon. William B. Wilson, Mr. Daniel Willard, Mr. Samuel Gompers, Committee of the Council of National Defense:

Gentlemen—In the national crisis precipitated by events of which we learned this afternoon, the National Conference Committee of the Railways joins with you in the conviction that neither at home nor abroad should there be fear or hope that the efficient operation of the railways of the country will be hampered or impaired.

Therefore, you are authorized to assure the nation that there will be no strike, and as a basis for such assurance we hereby authorize the Committee of the Council of National Defense to grant to employees who were about to strike whatever adjustment your committee deems necessary to guarantee the uninterrupted and efficient operation of the railways as an indispensable arm of national defense. Yours very truly,

The National Conference Committee of the Railways.
By ELISHA LEE, Chairman.

TEXT OF FINAL AGREEMENT

The text of the agreement in the railroad wage controversy, follows:

In all road service except passenger where the schedule now reads "a hundred miles or less, 9 or 10 hours or less, overtime at 10 or 11 miles per hour," insert "8 hours or less for a basic day and 12½ miles per hour for a speed basis; for the purpose of computing overtime."

Overtime to be paid for at not less than one-eighth of the daily rate per hour. In all yards switching and hostling service where the schedule now reads "10, 11 or 12 hours or less shall constitute a day's work," insert "eight hours or less shall constitute a day's work at the present 10 hours' pay, overtime to be paid for at not less than one-eighth the daily rate per hour."

In yards now working on an eight-hour basis, the daily rate shall be the present 10-hour standard rate with overtime to be paid for at not less than one-eighth of the daily rate per hour.

In case the law is decided unconstitutional, eight hours or less at the present 10-hour pay will constitute a day's work.

In passenger service the present mileage basis will be made on roads now having a flat 10-hour rate day in passenger service, the rule will be amended to read "eight within 10 hours."

For all classes of employees, in short turn-around passenger service, where the rule now reads "eight within 12 hours," it shall be amended to read "eight within 10 hours."

For such territory as has no number of hours for a day's work in a short turn-around passenger service, the "eight within 10 hours" rule applies.

The general committee on individual railroads may elect to retain their present overtime rules in short turn-around passenger service or the foregoing provisions, but may not make a combination of both to produce greater compensation than is provided in either basis.

In the event the law is held to be constitutional, if the foregoing settlement is inconsistent with the decision of the Court, the application will be adjusted to the decision.

If declared unconstitutional the above stands with all provisions as written.

The foregoing to govern for such roads, classes of employees and classes of service represented by the national conference committee of the railways.

Schedules except as modified by the above changes remain as at present.

(Signed) FRANKLIN K. LANE.
W. B. WILSON.
DANIEL WILLARD.
SAMUEL GOMPERS.

Accepted by W. G. Lee, president of the Brotherhood of Railway Trainmen. W. S. Stone, grand chief of the Brotherhood of Locomotive Engineers. L. E. Sheppard, acting president of the Order of Railroad Conductors. W. S. Carter, president of the Brotherhood of Locomotive Firemen and Enginemen. The National Conference Committee of Railways: By Elisha Lee, Chairman.

RAILROADS' ACTION APPRECIATED

The following statement, signed by Secretary Lane, Secretary Wilson, Daniel Willard and Samuel Gompers, was given out after the agreement was signed:

We desire to express our appreciation of the large and patriotic act of the railway men's committee which has put beyond peradventure the possibility of a nation-wide railroad strike.

The railroads have met the full demands of the Adamson eight-hour law. This concession was secured as the culmination of two days and two nights of negotiations.

Our first effort was to secure a postponement of the strike, which was fixed for Saturday night. This postponement was secured by presenting to the railway managers a memorandum drafted by the brotherhoods, which with some particularity expressed the provisions of the Adamson law. We asked the railways to agree that if the Adamson law was held to be Constitutional that this construction and application would be given to it. The railways agreed to this at a joint session of the brotherhood chiefs and managers, and with much difficulty the chiefs stayed the strike, an act which was vital to the success of our efforts at further mediation.

We next sought some adjustment that would be effective should the law be held unconstitutional. In this regard many propositions were made to both sides but none was acceptable until the railroads expressed a willingness to place the whole matter in the hands of this committee. This act proceeded, as the letter of the railway managers states, from a desire to demonstrate to the country that the railroads would not allow their own conception of railroad policy to stand in the way of the fullest use of roads at a time of severe national strain.

The committee considered the matter and decided in view of the action of Congress in passing the Adamson law and the necessity for immediate action, it was best to adopt the memorandum agreed on the previous day as applicable under all conditions. Thus the proposition of the eight-hour law by agreement between the roads and the men became the basis of settlement and whether the Supreme Court holds for the validity of the law or against it, there will be no strike.

SECRETARY LANE ON SUPREME COURT DECISION

When the decision of the Supreme Court was announced at 12:30 noon, Monday, Secretary Lane made the following comments:

"We have now an interpretation of the meaning of the Adamson law, framed by the railroad brotherhoods themselves and accepted by the railway managers, so that the danger of confused construction or lengthy delay in putting the provisions into effect are avoided.

"It is an authoritative construction agreed to by both sides. One of the advantages of the policy which our committee followed in first obtaining a postponement of the strike is that it undoubtedly saved a large number of men from going out who might have had difficulty in getting back.

"The matter ends in a manner which is satisfactory to the employees, and, at the same time, the railroads by their course gave evidence of their high sense of unwillingness to permit any embarrassment to the country at the time of extreme strain, because of their own persistence in a policy which they did not like to break down but which they were willing to give up."

Commenting upon the situation, Frank Trumbull, chairman of the Railway Executives' Advisory Committee and chairman of the board of the Chesapeake & Ohio, made this statement:

"In view of the great crisis which the nation faces this morning, I think the disposition made of the labor controversy was both wise and patriotic. The decision was left to a governmental body where the responsibility properly rests. I believe that this conclusion emphasizes more than ever the necessity for national treatment of the railroads, and the importance of unified control in the public interest. I feel that it should also promote friendliness in all quarters for the railroads, and be accepted as evidence of their sincere desire to co-operate in every possible manner to render the service expected of them. It is the wish of the railway executives to treat their employees fairly, but they are compelled to recognize the limitations put upon them by public regulation, which denies them the freedom of action granted to other lines of business. The railroads must now look to the public for their co-operation in the burden they have assumed. Particularly do they ask that unselfish and intelligent attention be given the whole problem, and the railroads be treated in this emergency as they deserve to be, as great *national assets*."

The Adamson Law Held to Be Constitutional

Supreme Court Holds That Congress Has the Right to Regulate Wages in the Interests of the Public

THE Supreme Court of the United States on Monday rendered its decision in the suit instituted by the railroads to test the constitutionality of the Adamson eight-hour law passed by Congress last September. The majority of the court held the law to be constitutional and valid in all respects, and reversed the judgment of Judge Hook, of the Federal Court at Kansas City, who had issued an injunction restraining its enforcement in order to expedite the case. Justices Day and Pitney read dissenting opinions, Justice Vandevanter concurred in that of Justice Pitney, and Justice McReynolds expressed views somewhat different from those of the minority but dissented from the majority decision.

The majority opinion follows:

Was there power in Congress under the circumstances existing to deal with the hours of work and wages of railroad employees engaged in interstate commerce, is the principal question here to be considered.

Its solution, as well as that of other questions which also arise, will be clarified by a brief statement of the conditions out of which the controversy arose.

Two systems controlled in March, 1916, concerning wages of railroad employees: One, an eight-hour standard of work and wages, with additional pay for overtime, governing on about 15 per cent of the railroads; the other, a stated mileage task of 100 miles to be performed during ten hours, with extra pay for any excess, in force on about 85 per cent of the roads.

The organizations representing the employees of the railroads in that month made a formal demand upon the employers that, as to all engaged in the movement of trains except passenger trains, the 100-mile task be fixed for eight hours, provided that it was not so done as to lower wages, and provided that an extra allowance for overtime calculated by the minute at one and one-half time the rate of the regular hours' service be established.

Demands of Brotherhoods

The demand made for a standard obligatory on the railroads but optional on the employees, as it left the right to the employees to retain their existing system on any particular road if they elected to do so. The terms of the demand were as follows, except the one which reserved the option, and others making Article 1 applicable to yard and switching and hostling service:

Article 1—(A) In all road service, 100 miles or less, eight hours or less will constitute a day except in passenger service. Miles in excess of 100 will be paid for at the same rate per mile.

(B) On runs of 100 miles or less overtime will begin at the expiration of eight hours.

(C) On runs of over 100 miles overtime will begin when the time on duty exceeds the miles run divided by 12½ miles per hour.

(D) All overtime to be computed on the minute basis and paid for at time and one-half times the pro rata rate.

(E) No one shall receive less for eight hours or 100 miles than they now receive for a minimum day or 100 miles for the class of engine used or for service performed.

(F) Time will be computed continuously from time required for duty until release from duty and responsibility at end of day or run.

The employers refused the demand and the employees, through their organizations, by concert of action took the steps to call a general strike of all railroad employees throughout the whole country.

The President of the United States invited a conference between the parties. He proposed arbitration. The employers agreed to it and the employees rejected it. The President then suggested the eight-hour standard of work and wages. The employers rejected this and the employees accepted it. Before the disagreement was resolved the representatives of the employees abruptly called a general strike throughout the whole country, fixed for an early day. The President, stating his efforts to relieve the situation and pointing out that no resources at law were at his disposal for compulsory arbitration to save the commercial disaster, the property injury and the personal suffering of all, not to say starvation which would be brought to many among the vast body of the people if the strike was not prevented, asked Congress, first, that the eight-hour standard of work and wages be fixed by law, and, second, that an official body be created to observe, during a reasonable time, the operation of the legislation and that an explicit assurance be given that if the result of such observation established such an increased cost to the employers as justified an increased rate, the power, would be given to the Interstate Commerce Commission to authorize it. Congress responded by enacting the statute, whose validity, as we have said, we are called upon to consider.

Question of Constitutionality

The duty to do so arises from the fact that the employers, unwilling to accept the act and challenging the constitutional power of Congress to enact it, began this typical suit against the officers of certain labor unions and the United States District Attorney to enjoin the enforcement of the statute.

The law was made to take effect only on January 1, 1917. To expedite the final decision before that date, the representatives of the labor unions were dropped out, agreements essential to hasten it were made, and it was stipulated that pending the final disposition of the cause that carriers would keep accounts of the wages which would have been earned if the statute was enforced so as to enable their payment if the law was finally upheld.

Stating its desire to co-operate with the parties in their purpose to expedite the cause, the court below, briefly announcing that it was of opinion that Congress had no constitutional power to enact the statute, enjoined its enforcement, and as the result of the direct appeal which followed, we come after elaborate oral and printed arguments, to dispose of the controversy.

All the proposition relied upon and arguments advanced ultimately come to two questions:

First, the entire want of constitutional power to deal with the subjects embraced by the statute, and, second, such abuse of the power if possessed as rendered its exercise unconstitutional. We will consider these subjects under distinct propositions separately.

There must be knowledge of the power exerted before determining whether as exercised it was constitutional, and we must hence settle a dispute on that question before going further. Only an eight-hour standard for work and wages was provided, is the contention on the one side, and in substance only a scale of wages was provided, is the argument on the other. We are of the opinion that both are right and, in a sense, both wrong in so far as it is assumed that the one excludes the other. * * * Both provisions are equally mandatory. * * * However, there is this very broad difference between the two powers exerted. The first, the eight-hour standard, is permanently fixed. The second, the fixing of the wage standard resulting from the prohibition against paying lower wages, is expressly limited

to the time specified in Section 2 (of the law.) It is, therefore, not permanent, but temporary, leaving the employers and employees free as to the subject of wages to govern their relations by their own agreements after the specified time.

Right to Fix Hours

Concretely stated, therefore, the question is this: Did Congress have power under the circumstances * * * to provide a permanent eight-hour standard and to create by legislative action a standard of wages to be operative upon the employers and employees for such reasonable time as it deemed necessary to afford an opportunity for the meeting of the minds of employers and employees on the subject of wages?

Coming to the general considerations * * * we put the question as to the eight-hour standard entirely out of view on the ground that the authority to permanently establish it is so clearly sustained as to render the subject not disputable.

What was the extent of the power, therefore, of Congress to regulate, considering the scope of regulation which the Government had the right to exert with references to interstate commerce carriers when it came to exercise its legislative authority to regulate commerce, is the matter to be decided. That the business of common carriers by rail is in a sense a public business * * * is settled by so many decisions, State and Federal, and is illustrated by such a continuous exertion of State and Federal legislative power as to leave no room for question on the subject.

If the situation which we have described and with which the act of Congress dealt be taken into view * * * it would seem inevitably to result that the power to regulate necessarily obtained and was subject to be applied to the extent necessary to provide a remedy for the situation. * * * This must be, unless it can be said that the right to so regulate as to save and protect the public interest did not apply to a case where the destruction of the public right was imminent as the result of a dispute between the parties and their consequent failure to establish by private agreement the standard of wages which was essential; in other words, that the existence of the public right and the public power to preserve it was wholly under the control of the private right to establish a standard by agreement. Nor is it an answer to this view to suggest that the situation was one of emergency, and that emergency cannot be made the source of power. The proposition begs the question, since although an emergency may not call into life a power which has never lived, nevertheless emergency may afford a reason for the exertion of a living power already enjoyed. If acts which if done would interrupt, if not destroy, interstate commerce, may be by anticipation legislatively prevented, by the same token the power to regulate may be exercised to guard against the cessation of interstate commerce threatened by a failure of employers and employees to agree as to the standard of wages, such standard being an essential prerequisite to the uninterrupted flow of interstate commerce.

Powers of Congress

(At this point the Chief Justice recounted at length the acknowledged powers of Congress to regulate commerce.)

In the presence of this vast body of acknowledged powers, there would seem to be no ground for disputing the power which was exercised in the act which is before us so as to prescribe by law for the absence of a standard of wages caused by the failure to exercise the private right * * * to the end that no individual dispute or difference might bring ruin to the vast interests concerned. * * * What would be the value of the right to a reasonable rate if all movement in interstate commerce could be stopped as a result of a mere dispute between the parties of their failure to exert a primary private right concerning a matter of interstate commerce? Again what purpose would be subserved by all the regulations established to secure the enjoyment by the public of an efficient and reasonable service if there was no power in Government to prevent all service from being destroyed?

Further yet, what benefits would flow to society by recognizing the right, because of the public interest, to regulate the relation of employer and employee and of the employees among themselves, and to give to the latter peculiar and special rights safeguarding their persons, protecting them in case of accident, and giving efficient remedies for that purpose, if there was no power to remedy a situation created by a dispute between employers and employees as to rate of wages, which, if not remedied, would leave the public helpless, the whole people ruined, and all the homes of the land submitted to a danger of the most serious character?

And, finally, to what decision would it not reduce the proposition that the Government had power to enforce the duty of operation, if that power did not extend to doing that which was essential to prevent operation from being completely stopped by filling the interregnum created by an absence of a conventional standard of wages because of a dispute on that subject between the employers and employees by a legislative standard binding on employers and employees for such a time as might be deemed by the Legislature reasonably adequate to enable normal conditions to come about as the result of agreements as to wages between the parties?

We are of opinion that the reasons stated conclusively establish that from the point of view of inherent power the act which is before us was clearly within the legislative power of Congress to adopt, and that in substance and effect it amounted to an exertion of its authority under the circumstances disclosed to compulsorily arbitrate the dispute between the parties by establishing, as to the subject matter of that dispute, a legislative standard of wages operative and binding as a matter of law upon the parties—a power none the less efficaciously exerted because exercised by direct legislative act instead of the enactment of other and appropriate means providing for the bringing about of such result.

If it be conceded that the power to enact the statute was in effect the exercise of the rights to fix wages where by reason of the dispute there had been a failure to fix by agreement, it would simply serve to show the nature and character of the regulation essential to protect the public right and safeguard the movement of interstate commerce, not involving any denial of the authority to adopt it.

And this leaves only to be generally considered whether the right to exercise such a power under the conditions which existed was limited or restrained by the private rights of the carriers or their employees.

As to the carrier, as engaging in the business of interstate commerce subjects the carrier to the lawful power of Congress to regulate * * * it follows that the very absence of the scale of wages by agreement and the impediment and destruction of interstate commerce which was threatened called for the appropriate and relevant remedy, the creation of a standard by operation of law binding upon the carrier.

Rights of the Public

As to the employee; here again it is obvious that what we have previously said is applicable and decisive, since whatever would be the right of an employee engaged in a private business to demand such wages as he desires, to

leave the employment if he does not get them and by concert of action to agree with others to leave upon the same condition, such rights are necessarily subject to limitation when employment is accepted in a business charged with a public interest, and as to which the power to regulate commerce possessed by Congress applied and the resulting right to fix in a case of disagreement and dispute a standard of wages as we have seen necessarily obtained.

In other words, considering comprehensively the situation of the employer and the employee in the light of the obligations arising from the public interest and of the work in which they are engaged and the degree of regulation which may be lawfully exerted by Congress as to that business, it must follow that the exercise of the lawful governmental right is controlling.

This results from the considerations which, * * * we repeat, since conceding that from the point of view of the private right and private interest as contradistinguished from the public interest the power exists between * * * employers and employees, to agree as to a standard of wages free from legislative interference, that right in no way affects the lawmaking power to protect the public right and create a standard of wages resulting from a dispute as to wages and a failure therefore to establish by consent a standard.

The capacity to exercise the private right free from legislative interference affords no ground for saying that legislative power does not exist to protect the public interest from the injury resulting from a failure to exercise the private right. In saying this, of course, it is always to be borne in mind that as to both carrier and employee the beneficent and ever-present safeguards of the Constitution are applicable, and therefore both are protected against confiscation and against every act of arbitrary power which if given effect to would amount to a denial of due process or would be repugnant to any other constitutional right.

No Question of Private Right

And this emphasizes that there is no question here of purely private right.

Having thus adversely disposed of the contentions as to the inherent want of power, we come to consider all the other propositions which group themselves under a common heading, that is:

Second, such an abuse of the power if possessed as rendered its exercise unconstitutional.

The want of equality is based upon two considerations. The one is the exemption of certain short line and electric railroads. We dismiss it because it has been adversely disposed of by many previous decisions. The second rests upon the charge that unlawful inequality results because the statute deals not with all, but only with the wages of employees engaged in the movement of trains. But such employees were those concerning whom the dispute in which wages existed, growing out of which the threat of interruption of interstate commerce arose—a consideration which establishes an adequate basis for the statutory classification.

As to penalties, it suffices to say that in this case a recovery of penalties is not asked and consequently the subject may well be postponed until it actually arises for decision. (At this point the Chief Justice dealt at length with the argument that the law was "unworkable.")

Considering the extreme contentions relied upon in the light of this situation we can discover no basis upon which they may rest. * * * When it is considered that no contention is made that in any view the enforcement of the act would result in confiscation, the misconception upon which all the propositions proceed become apparent.

Finally, we say that the contention that the act was void and could not be made operative because of the unworkability of its provisions, is without merit; since we see no reason to doubt that if the standard fixed by the act were made applicable and a candid effort followed to carry it out, the result would be without difficulty accomplished. It is true that it might follow that in some cases because of particular terms of employment or exceptional surroundings some change might be necessary, but these exceptions afford no ground for holding the act void because its provisions are not susceptible in practice of being carried out.

Being of the opinion that Congress had the power to adopt the act in question, whether it be viewed as a direct fixing of wages to meet the absence of a standard on that subject resulting from the dispute between the parties or as the exertion by Congress of the power which it undoubtedly possessed to provide by appropriate legislation for compulsory arbitration—a power which inevitably resulted from its authority to protect interstate commerce in dealing with a situation like that which was before it—we conclude that the court below erred in holding the statute was not within the power of Congress to enact and in restraining its enforcement, and its decree therefore must be and it is reversed and the cause remanded with directions to dismiss the bill."

Dissenting Opinions

Holding the Adamson act an "arbitrary and unreasonable taking of property from the railroads without due process of law, experimental and admittedly enacted without due deliberation," Justice Day dissented, although he said, he was not prepared to say Congress is without power to regulate railroad wages. He expressly said, however, he did not believe Congress has power to enforce compulsory arbitration.

I agree that to secure proper service and to insure reasonable rates to the public * * * Congress has the power to fix the amount of compensation, he said, adding that this power must be exercised subject to usual constitutional limitations of "due process" of law.

Stating that the law provides temporary pay for eight hours' service formerly required for ten hours, Justice Day said:

In other words, Congress expresses its inability to fix in advance of investigation a just and proper wage. It inevitably follows that the cost of the experiment, many millions of dollars, must be paid not by the public, but by legislative edict is made to fall entirely upon one of the parties. Inherently, such legislation requires that such investigation and deliberation shall precede action. Nevertheless, Congress has in this act itself declared the lack of sufficient information and knowledge to warrant the action taken, and has directed an experiment to determine what it should do.

Such legislation, it seems to me, amounts to the taking of the property of one and giving it to another in violation of the spirit of fair play and due process clause. No emergency, whatever the character, could justify the violation of constitutional rights.

Justice McReynolds's Views

Justice McReynolds's dissenting opinion said:

Whatever else the act may do, it certainly commands that during a minimum period of seven months interstate carriers by railroad shall pay their employees engaged in operating trains for eight hours' work a wage not less than the one then established for a standard day—generally of ten hours.

I have not heretofore supposed that such action was a regulation of commerce within the fair intendment of those words as used in the Constitution; and the argument advanced in support of the contrary view is unsatisfactory

to my mind. I cannot, therefore, concur in the conclusion that it was within the power of Congress to enact the statute.

JUSTICES PITNEY AND VAN DEVANTER

Justice Pitney, for himself and Justice Van Devanter, delivered a dissenting opinion expressing concurrence in the view of Justice Day that the Adamson law was unconstitutional, because Congress, although confessedly not in possession of the information necessary for intelligent and just treatment of the controversy between carriers and the trainmen, arbitrarily imposed upon the carriers the entire and enormous cost of an experimental increase in wages, without providing for any compensation to be paid in case the investigation should demonstrate the impropriety of the increase.

Justice Pitney's opinion expressed the view of himself and Justice Van Devanter that the act is unconstitutional on the further and more fundamental ground that it is not a proper and legitimate regulation of commerce within the meaning of the Constitution; that it does not establish eight hours as the limit of a day's work, there being no prohibition of service in excess of eight hours per day, nor any penalty for overtime work; that the act merely provides that eight hours shall be treated as the measure or standard of a day's work for the purpose of reckoning compensation for services.

Justice Pitney said that the act cannot be sustained as a regulation of commerce because it has no such operation or effect; prescribed no service to the public; does not regulate the mode in which service is to be performed, or the safeguard to be placed about it, or the qualifications or conduct of those who are to perform it, and has no closer relation to or connection with commerce than has the price which the carrier pays for its engines and cars or for the coal used in propelling them.

The trainmen having accepted employment under the carriers in interstate commerce, so that employers and employees all engaged together in a quasi-public service, the act simply sets in and prescribes how the money earned in the public service shall be divided between the employers and the employees; this being a regulation not of commerce, but of the internal concerns of the commerce carriers, precisely as if the act were to provide that the rate of interest payable to the bondholders must be decreased and the dividend payments to the stockholders correspondingly increased.

That the act cannot be sustained as analogous to the power to fix rates of freight and fare or as a branch of that power. The interests of the public in the regulation of rates lies in limiting the carrier to a reasonable compensation, and is in the direction of lowering, not increasing expenses, while the present act has for its purpose and necessary effect the increasing of expenses.

That the act cannot be sustained as an emergency measure, for an emergency cannot create a power nor excuse a defiance of the constitutional limitations upon the powers of the Government.

If the public exigency required it, Congress perhaps might appropriate public moneys to satisfy the demands of the trainmen; but there is no argument for requiring the carriers to pay the cost that would not apply equally to renewed demands as often as made, if made by men who had the power to tie up traffic.

And that the act usurps the right of the owners of the railroads to manage their own property in matters not affecting the character of the service, and is an attempt to control and manage them rather than to regulate commerce. In particular it deprives the railroad companies of their constitutional right to agree with their employees as to the terms of employment.

THE FIRE HAZARD OF THE HAND LANTERN*

A recent compilation made from the records of the Bureau brings forth most emphatically the facts with regard to the fire hazard connected with the ordinary use of a trainman's hand lantern, and its liability to ignite inflammable vapors arising from leaking liquids. Practically all of the oils with flash point below 200 deg. F. permit the formation of vapors that may be easily ignited by a flame, but oils or liquids with flash points below 80 deg. F. possess in a greater degree these dangerous characteristics. Alcohol, if leaking from its container, in a car or warehouse wherein the temperature is about 60 deg. F., will vaporize and the vapor is easily ignited—gasoline at a temperature of 0 deg. F., whisky at 81 deg. to 85 deg. F., turpentine at 105 deg. F., kerosene at 115 deg. to 130 deg. F. The presence of a glass globe surrounding the lighted wick of a hand lantern does not prevent the flame from doing its work.

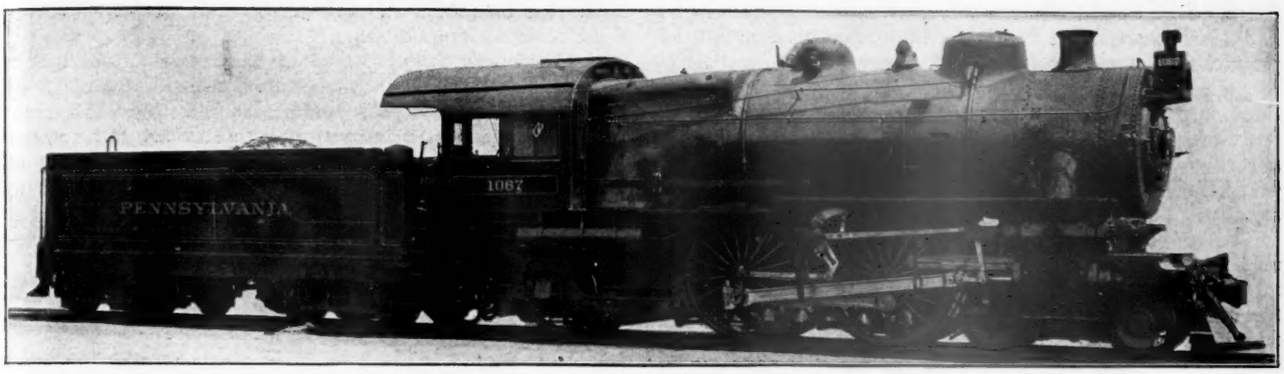
Inflammable vapors are usually heavier than air and in a closed car or warehouse will be found along the floor. Instances are recorded where barrels of illuminating oil and gasoline were in leaking condition in a car and a hand lantern was set upon the head of a barrel, but when the lantern was moved to the floor of the car, immediate ignition of the vapors occurred. Many accidents have occurred due to the use of a lantern for the purpose of ascertaining whether a tank car was empty or filled. While, as a rule, such accidents do but little more than cause severe or fatal injuries to the employee involved, they may be the cause of serious fires. Leaking receptacles of any kind should never be approached with any exposed flame. [Mr. Topping cited examples of fires due to ignition caused by a lighted lantern in cases of leakage of alcohol, leather cement, gasoline (tank car leaking), gasoline (tank car in derailment), gasoline (draining automobile in freight house), and others.]

The regulations covering the transportation of explosives and other dangerous articles include the caution "Keep Lights and Fires Away," on every car containing an inflammable liquid in quantity, but it seems quite difficult to impress on the minds of employees the fact that a hand lantern is a "light." Every man to whom a lantern is furnished could be given a card bearing a picture of a lantern and these or similar instructions:

"SAFETY FIRST"
Lantern
DO NOT lower a lighted lantern into tank cars!
KEEP AWAY from domes!
DO NOT carry into box cars full of inflammable vapors—your nose will tell you of their presence.
DO NOT use under or near cars from which inflammable liquids are leaking!
KEEP AWAY from wrecked cars placarded "Inflammable!"
KEEP AWAY from leaking drums, barrels or other packages bearing RED labels!
"PREVENT FIRES"

Where fires have been due to failure on the part of an employee to obey proper cautionary rules, the railway officer should use the report as a means of information and warning . . . .

*From a paper by W. S. Topping, of the Bureau of Explosives, in the Quarterly Bulletin of the Railway Fire Protection Association.



Pennsylvania Atlantic Type Locomotive Tests

A Demonstration of the Value of the Test Plant in the Determination of Correct Locomotive Proportions

By Andrew C. Loudon

THE *Railway Age Gazette* has frequently referred to the work that has been done on the Pennsylvania Railroad in the past few years in the way of locomotive development, but little has been published regarding the actual performance, in detail, of the locomotives as determined on the testing plant at Altoona. It is proposed, therefore, to give some account of the general performance of the three types which have so far been developed to a condition of economy and capacity which has warranted their building in considerable numbers. These types are the Atlantic (Pennsylvania Railroad class E6s), Pacific (class K4s) and Mikado (class L1s). The Atlantic type engine was described in the *Railway Age Gazette*, February 20, 1914, and the other two July 3, 1914. The results of the tests of the Pacific and Mikado types will be dealt with later. The figures given in this article are from Locomotive Testing Plant Bulletin No. 27 of the Pennsylvania Railroad, entitled "Tests of a Class E6s Locomotive."*

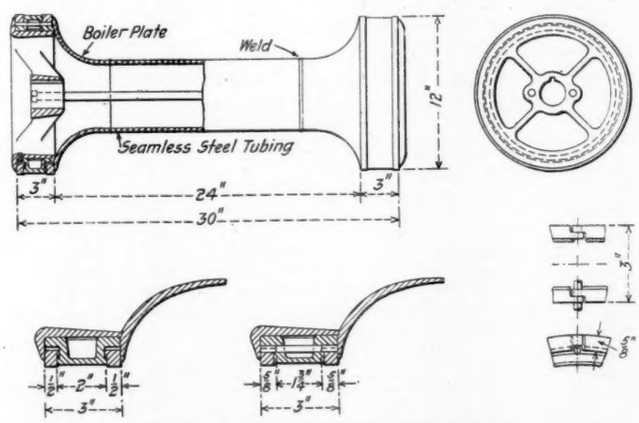


Fig. 1—Piston Valve Used in the Class E6s Locomotives

The development of the most recent form of the Atlantic type locomotive on this road extended over a number of years and the testing plant at Altoona took a prominent part in it. In 1910 a locomotive of the E6 class using saturated steam was built. In 1912 this locomotive had a superheater added and its classification was changed to E6s. One more locomotive of the E6s class was built at this time and one class E6sa, differing from the others in having a special valve and valve gear. There were then two E6s and one E6sa locomotives; these had tubes 13 ft. 8⅝ in. long and cylinders 22 in. by 26 in. In 1913 the three locomotives were rebuilt with new cylinders 23½ in. by 26 in. and with other changes, but with no change in tube length. After June 1, 1913, a large number of locomotives of the E6s class with 15-ft. tubes were built, and one of these latter, No. 51, is the subject of this article. The E6 and E6sa classes no longer exist. There are now no locomotives like Nos. 89 and 5075, figures for which are given, in comparison with those obtained from No. 51, which is the finally adopted form of the E6s class.

The general dimensions of the two locomotives of the E6s class are as follows:

	Old E6s No. 89	New E6s No. 51
Total weight, working order, lb	234,200	240,000
Weight on drivers, working order, lb	141,000	133,100
Cylinders (simple), diam. and stroke, in	22 by 26	23½ by 26
Driving wheels, diameter, in	80	80
Heating surface, tube (water side), sq. ft.	2,404.9	2,634.5
Heating surface, firebox, including arch tubes, sq. ft.	254.5	232.7
Heating surface, superheater (fireside), sq. ft.	688.8	810.6
Heating surface, total (based on water side of tubes), including superheater, sq. ft.	3,348.2	3,677.8
Heating surface, total (based on fire side of tubes), including superheater, sq. ft.	3,089.5	3,405.6
Grate area, sq. ft.	55.23	55.79
Boiler pressure, lb. per sq. in.	205	205
Valves, type	14 in. piston	12 in. piston
Valve gear	Walschaert	Walschaert
Firebox, type	Wide, Belpaire	Wide, Belpaire
Tubes, number and outside diameter	242—2 in.	242—2 in.
Flues, number and outside diameter	36—5¾ in.	36—5¾ in.
Tubes and flues, length, in.	164.63	179.71

Both locomotives were equipped with brick arches.

Experiment has shown that if boiler tubes are increased in length without an increase in diameter, there is a point beyond which the lengthening of the tubes fails to produce a proportional increase in evaporation, the effect being partly due to the increasing resistance to the flow of gases and the consequent retardation of combustion in the firebox. But for best results the tubes should be extended fully up to the point where the increase in evaporation ceases to be proportional to the increase in length. It has been found on the Pennsylvania that the most desirable length for a tube is about 100 times its internal diameter and this rule has been adopted with a leeway to the designer of 10 or 15 per cent to satisfy other boiler conditions. In the first E6 boiler the tubes had a ratio of length to internal diameter of 94; in the new boiler, with 15-ft. tubes, the ratio is 103.

It will be noted that the final form of the E6s locomotive

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uses a 12-in. diameter piston valve, while the original engine had 14-in. valves. It has been found that this is entirely practicable from the fact that superheated steam flows through the steam passages with greater freedom than saturated steam of the same pressure, making it possible to restrict the passages to some extent. The entire design of piston valve and valve gear has been completely revised, the gear being much lighter and at the same time giving greater rigidity. The new form of valve is shown in Fig. 1.

The reciprocating parts of this latest engine are remarkable for their light weight, and in spite of the fact that the maximum weight on a pair of drivers is now 67,000 lb., the dynamic augment or the increased pressure on the rail due to the unbalanced revolving weights at 70 miles an hour, is less than 30 per cent of the static weight on the drivers; or no greater than that with many locomotives having from 10,000 to 12,000 lb. less weight per axle, but with heavy reciprocating parts. The great care in the design of these reciprocating parts has made possible a locomotive of this type which is more powerful than many locomotives of the Pacific type, while it has less destructive action on the track. The light weight of the reciprocating parts of this

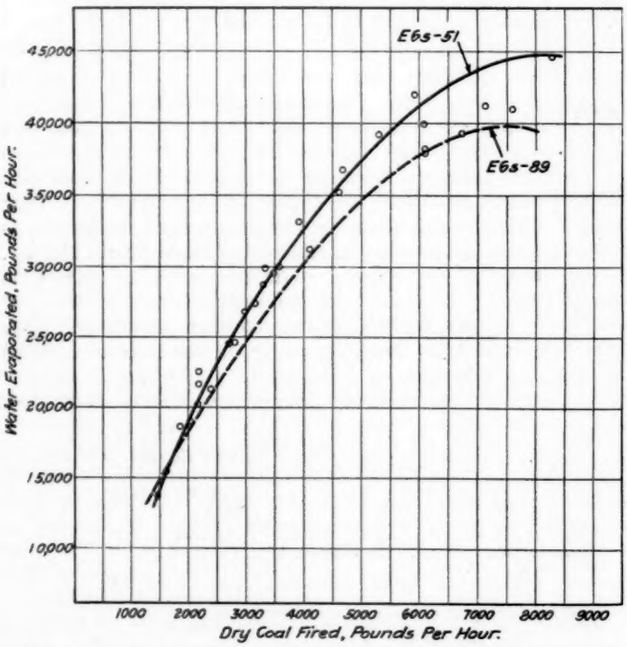


Fig. 2—Relation of Dry Coal Fired to Water Evaporated

and other Pennsylvania Railroad locomotives is shown clearly in a series of articles by H. A. F. Campbell in the Railway Age Gazette, Mechanical Edition, for March, April, May and September, 1915.

Boiler Performance

The coal used in the tests of No. 51 was the same as that used with No. 89, being bituminous from Westmoreland county with 58.45 per cent carbon, 33.65 per cent volatile matter, 1.54 per cent moisture and 6.36 per cent ash, the sulphur, separately determined being 1.62 per cent. This fuel has a heat value of 14,470 B. t. u. per lb., dry, and 14,513 b. t. u. per lb. of combustible.

The exhaust nozzle used in No. 51 was of a type developed on the Pennsylvania and now in general use on that road. It has four internal projections or partial bridges. These break up the continuity of the stream from the nozzle to a certain extent, which has proved advantageous. This nozzle was described in the *Railway Age Gazette* April 9, 1915. One of these nozzles, with an area of 30.68 sq. in., or equivalent to a 6.25-in. diameter circular nozzle, gave the highest actual evaporation, 44,628 lb. of water per hour. A similar nozzle with an area of 27.06 sq. in. produced a maximum evaporation of 42,420 lb. per hour at a speed of 240 r.p.m. with a cut-off of 45 per cent. The maximum evaporation of 44,628 lb. was at a rate of 5.4 lb. of water per lb. of coal, or an equivalent evaporation of 7.09 lb. of water per lb. of dry coal, the superheat being 204 deg. and the boiler efficiency 48.59 per cent.

After a few tests of No. 51 it was found that the smoke-

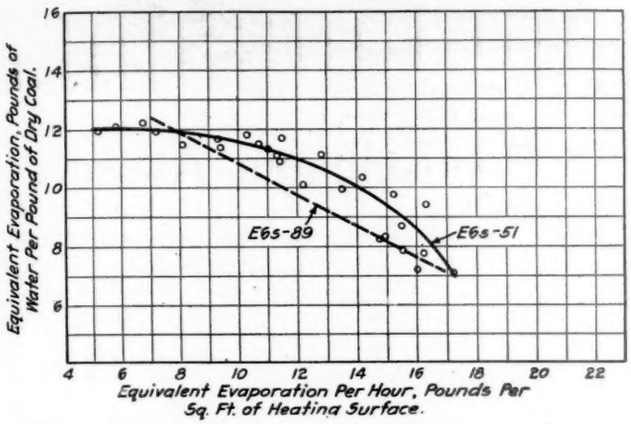


Fig. 3—Equivalent Evaporation per Pound of Dry Coal

box was not cleaning properly. The pocket in the diaphragm plate around the nozzle was made of a solid plate instead of netting, and an extension was made at the forward end of the diaphragm plate. This corrected the smokebox trouble. The following table shows the smokebox draft:

Pounds of water evaporated per hour, actual	Draft in smokebox, in. of water			
	Right side	Left side	Top	Bottom
15,492	1.5	1.5	1.4	1.1
20,200	2.1	2.1	2.1	2.2
24,645	3.2	3.3	3.1	3.1
30,008	4.3	4.2	4.0	3.4
35,238	5.8	5.7	5.6	...
40,063	8.1	7.8	7.7	8.5
44,628	9.6	9.3	9.3	10.1

In front of the diaphragm the draft increased to 15.1 in. of water when the rate of firing reached 150.56 lb. of coal

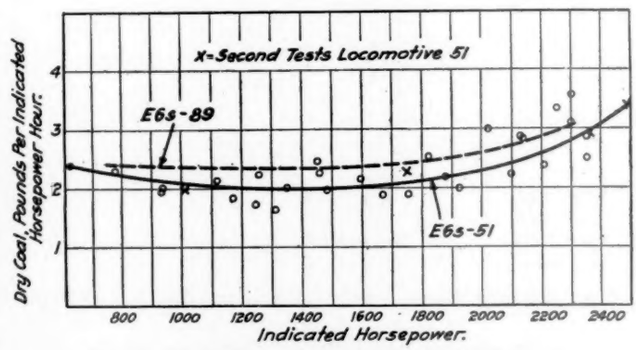


Fig. 4—Coal Rate and Indicated Horsepower

per sq. ft. of grate per hour; the draft back of the diaphragm was 9.4 in.; in the firebox 3.5 in. and in the ashpan 0.40 in.

The vacuum in the ashpan is somewhat higher than that obtained with No. 89. At a speed of 200 r.p.m. and 50 per cent cut-off, the rate of combustion for No. 51 was 148.25 lb. of coal per sq. ft. of grate per hour and the vacuum in the ashpan was 0.40 in., while No. 89 burned 142.17 lb. of coal per sq. ft. of grate per hour with 0.15 in. vacuum. The area of the air inlets to the ashpan of No. 89 was 8.1 sq. ft., or 14.6 per cent of the total grate area. In the test of loco-

motive No. 51 the corresponding figures are 7.85 sq. ft., or 14 per cent.

That the longer boiler tubes absorb more heat was indicated by slightly lower smokebox temperatures in No. 51 than in No. 89. In the new engine the temperatures ranged between 436 and 663 deg. F., being always below 700 deg. F., while in No. 89 the smokebox temperature reached as high as 770 deg. F.

The dry coal fired per hour ranged between 1,477 and

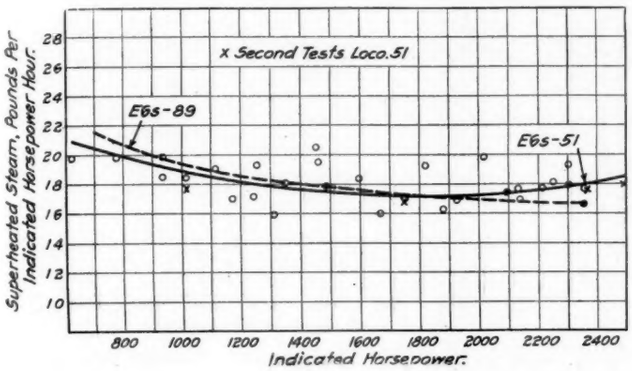


Fig. 5—Relation of the Water Rate to Indicated Horsepower

8,271 lb., and the rate of combustion per sq. ft. of grate per hour from 26.47 lb. to 148.25 lb. Based on a square foot of heating surface it ranged between 0.434 and 2.429 lb. The heat absorbed by the superheater ranged from 6 to 9.5 per cent, or less than 10 per cent of that absorbed by the water heating surfaces. The combustion rate increased regularly with the draft up to a rate of firing of approximately 148

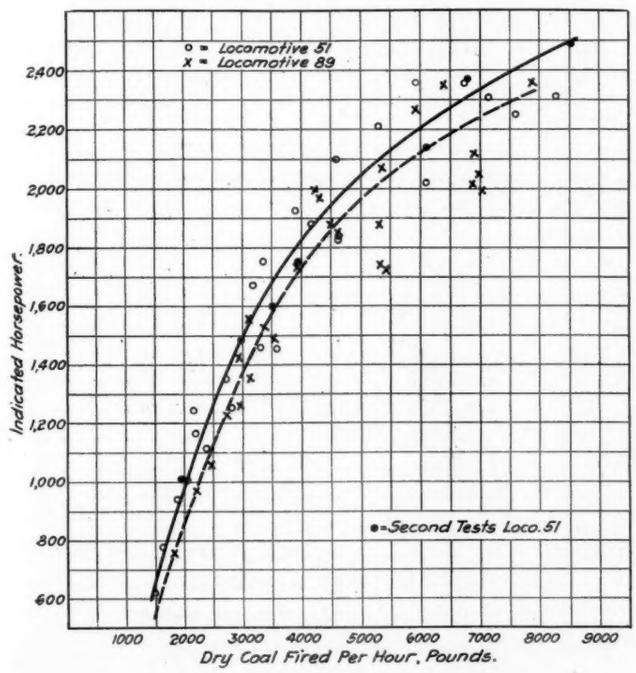


Fig. 6—Coal Fired and Indicated Horsepower

lb. of dry coal per hour per sq. ft. of grate, when the maximum draft obtained was 15 in. of water. The indications were that with a further material increase in the rate of firing the draft would have been insufficient to promote good combustion. At the maximum rate of combustion, the distribution of the draft was 20 per cent in drawing air through the fuel bed, 40 per cent in moving the gases through the tubes and 37 per cent in drawing the gases from the back to the front of the diaphragm. The corresponding figures for No. 89 were 18.3 per cent from ashpan to firebox, 29.5 per cent from firebox to back of diaphragm, and 51 per cent from back to front of diaphragm. It is again evident that the lengthening of the tubes has proved advantageous, but locomotive No. 51 might have been the better for an increased ashpan air opening.

With an increase of heating surface over No. 89 of 10 per cent, No. 51 increased the maximum evaporation 15 per cent, or from 38,846 lb. per hour to 44,600 lb. per hour. This is shown by the curves in Fig. 2.

The boiler efficiency shows substantial improvement, ranging in the case of No. 51 between a figure of about 83 per cent at an evaporation rate of 18,000 lb. per hour, and slightly below 50 per cent at about 44,000 lb. per hour. As the curves for the two engines do not follow the same form, it is difficult to obtain exact figures of general comparison. However, plotting the boiler efficiency of the two locomotives

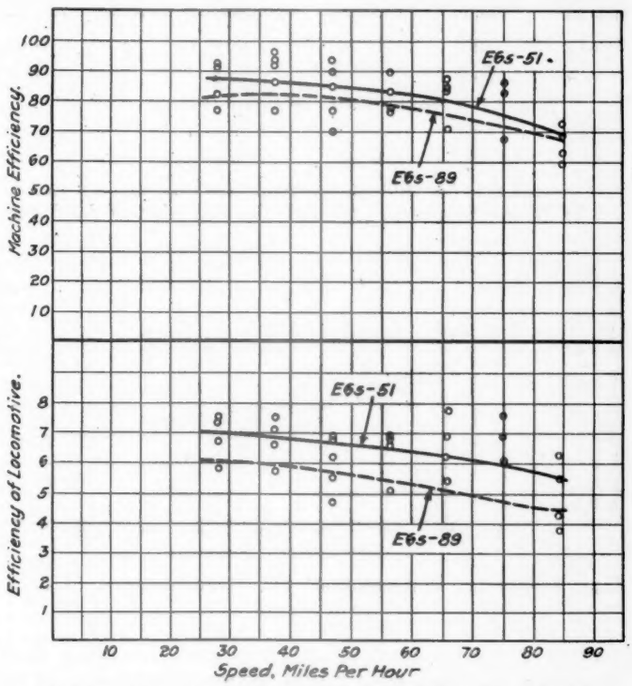


Fig. 7—Machine and Locomotive Efficiency Curves

on a base of dry coal per hour per sq. ft. of grate, the curves for both engines are straight lines and are parallel, the efficiency for No. 51 being about 9 per cent above that of No. 89. At a rate of about 40 lb. of dry coal per hour per sq. ft. of grate, the efficiency of the boiler of No. 51 is in the neighborhood of 83 per cent, dropping to about 50 per cent at 140 lb. per hour. The equivalent evaporation per lb. of coal is about 9 per cent greater for No. 51 than for No. 89, the range for No. 51 being between 12.5 lb. per lb. of dry coal at about 35 lb. of dry coal per hour per sq. ft. of grate and 7 lb. at a rate of 150 lb. of coal per hour.

Fig. 3 shows comparisons between the evaporations per lb. of coal at all rates of evaporation. This again shows improved results for No. 51 up to the maximum rate, where the two lines meet. The maximum rate of equivalent evaporation for No. 51 is 17.22 lb. per sq. ft. of heating surface per hour.

The maximum superheat obtained with No. 51 was 12.5 deg. above that obtained from the short tube boiler of No. 89, the range in superheat in the case of No. 51 being between 137 and 251.3 deg. F.

The shorter tube boiler showed a greater activity of com-

bustion for like drafts, but there was very little difference in the rapidity of evaporation in the two boilers until a draft of five inches of water was obtained back of the diaphragm. The shorter tube boiler then showed a more rapid rate until its evaporation limit was reached.

Engine Performance

The efficiency tests made with No. 51 on the testing plant were at speeds between 28.1 miles per hour (120 r.p.m.) and 84.4 miles per hour (360 r.p.m.), the nominal cut-offs being between 15 and 50 per cent.

At a speed of 28.1 m.p.h., and 15 per cent cut-off, the indicated horsepower was 620.3, while at 75 miles per hour and 35 per cent cut-off it was 2,357.2. In a second series of tests the indicated horsepower reached 2,488.9, or a horsepower for each 96.5 lb. of total weight. The following tables give the figures for the two series of tests:

First Tests, June and July, 1914

Boiler pressure	Superheat, deg. F.	Steam to engines, lb. per hour	Indicated horsepower	Dry coal per i.hp. hour, lb.	Steam per i.hp. hour, lb.
206.0	145.6	18,627	1,011.7	2.0	18.4
202.6	246.7	41,208	2,302.1	3.1	17.9
204.9	204.2	44,530	2,304.8	3.6	19.3
206.0	216.0	41,631	2,357.2	2.5	17.7

Second Tests, December, 1914

205.0	139.8	17,826	1,015.8	2.0	17.6
204.5	179.6	41,986	2,366.3	2.9	17.7
201.7	228.3	44,583	2,488.9	3.4	17.9

The coal rate per indicated horsepower hour did not exceed 3.6 lb. in the first tests, and with the exception of four tests

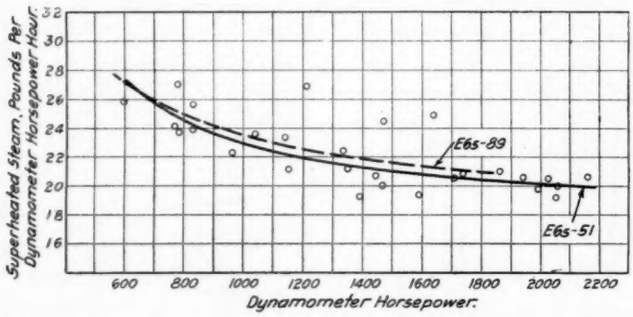


Fig. 8—Steam Consumption per Dynamometer Horsepower-Hour

the coal consumption was below 2.9 lb. per i.h.p. hour. The steam rate per i.hp. hour ranged between 16.07 and 20.56 lb. The maximum steam temperature reached (in the branch pipe) was 635.7 deg. F., or 251.3 deg. F. of superheat. The superheat in general was below 230 deg. F., there being little difference in the superheat obtained in No. 51 and No. 89. In neither case was the superheat below 137 deg. F.

The steam consumption per indicated horsepower hour is much the same for both No. 51 and No. 89 up to about 1,800 i.hp., beyond which the rate for No. 51 rises slightly. However, under what may be considered normal working conditions, or between 1,200 and 2,000 i.hp., the rate of water consumption of No. 51 is very satisfactory. The coal per i.hp. hour is lower for No. 51 than for No. 89 at all rates, due to the better boiler performance. This is shown in Fig. 4, and the water rate in Fig. 5. At horsepowers above 1,800, the tests of locomotive No. 51 show that the larger cylinders use slightly more steam than the cylinders of No. 89, but considering the coal rate and the increased boiler efficiency, the locomotive as a whole shows considerable improvement. Attention is called to the fact that with No. 89, the maximum indicated horsepower obtained was 2,355.2 at a speed of 360 r.p.m. or 84 m.p.h., and a cut-off of 36.1 per cent.

The curves in Fig. 6 show that No. 51 develops a greater horsepower than No. 89 at every rate of firing.

A single curve fairly represents both locomotives when steam per i.hp. hour is used as a base for plotting piston speed. Such a curve shows an improvement in steam consumption with an increase in piston speed up to 1,200 ft. per minute. The rate falls from about 20 lb. at 500 ft. per minute, to 17 lb. at 1,200 ft. per minute.

Considering the efficiency of the engines, and taking the

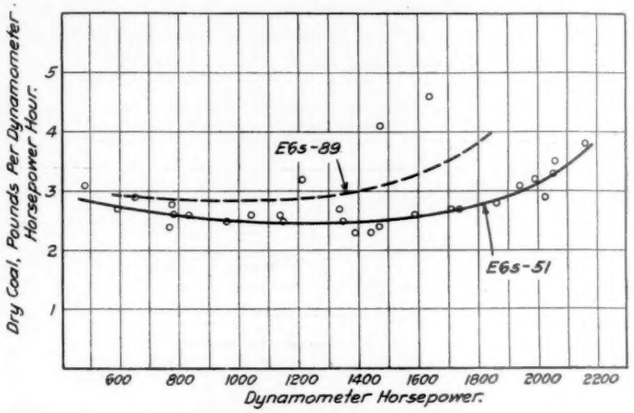


Fig. 9—Dry Coal per Dynamometer Horsepower-Hour

Rankine cycle as a base for an ideal engine, it is found that such an engine has an efficiency of 33.67 per cent. Considering this as 100 per cent, the actual engines developed an efficiency which was 67.8 per cent of the ideal. While from 11.6 to 14.1 per cent of the actual heat in the steam was turned into work (thermal efficiency), the engines approached within 33 per cent of the perfect engine. As the power increases there is an increase in the thermal efficiency

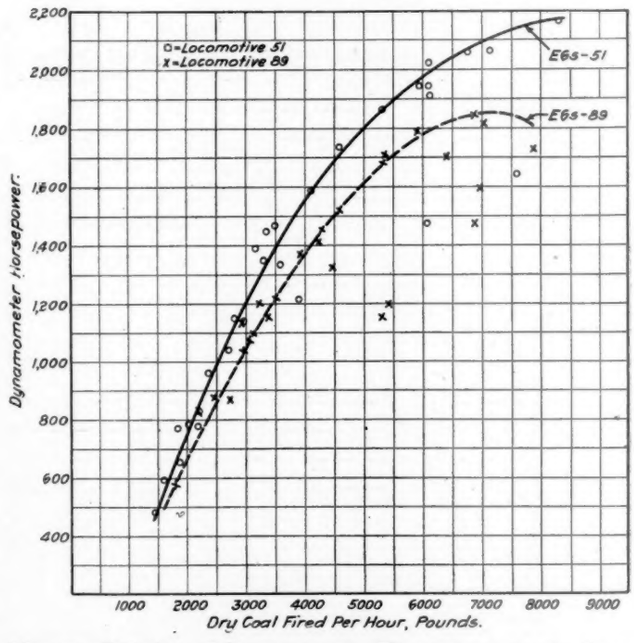


Fig. 10—Relation of Dynamometer Horsepower to the Rate of Firing

which decreases again at maximum power. With an indicated horsepower output between 600 and 2,400, the actual engines of these locomotives use from 11 to 14 per cent of the heat in the steam and discharge the rest to the exhaust. If the ideal engine could replace the actual engine, it could perform the same functions under identical conditions with approximately 60 per cent of the actual engine's steam consumption. As the rate of steam consumption decreases, with increased speed and shortened cut-off, this loss of power

becomes less and the performance of the actual engine approaches that of the ideal as a limit. For No. 89 the efficiency reached 86.5 per cent of the ideal. This was at about 85 miles per hour. The large amount of heat rejected in the exhaust (from 86 to 89 per cent) is indicative of the further saving possible by the use of a feedwater heater on locomotives using superheated steam. But the actual value of the superheater is conclusively shown in the table, which gives the comparative performance at equal weights of steam, and at a speed of 48 miles per hour, for three locomotives, No.

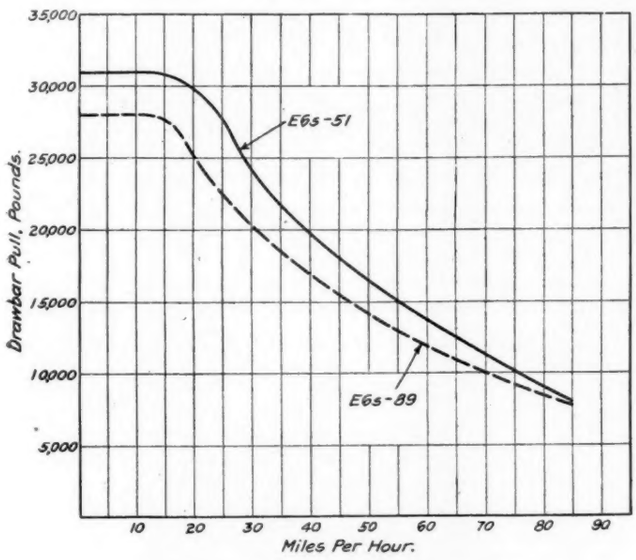


Fig. 11—Drawbar Pull Curves

51, No. 89, and No. 5075, the latter the class E6 engine, using saturated steam. This engine had cylinders 22 in. in diameter, the same as those of No. 89. Not only is greater power possible, but the advantage of a shorter cut-off is available over a greater range when the diameter of the superheater locomotive cylinder is increased above the limitations established by the use of saturated steam.

Locomotive No.	51	89	5075
Class	E 6s	E 6s	E 6
Steam per hour, lb.	37,713	38,028	37,335
Steam per i. hp. hour, lb.	17.70	18.86	24.14
Indicated horsepower	2,131	2,016	1,546
Mean effective pressure, lb.	95.97	104.1	79.0
Cut-off, per cent of stroke	45	55	32
Superheat, deg. F.	245.6	237.0	None

The following tables give the results of tests for determining the performance of locomotive No. 51 at the drawbar:

First Tests, June and July, 1914

Speed, miles per hour	Drawbar pull, lb.	Dynamometer horsepower	Coal per d. hp. hour, lb.	Steam per d. hp., lb.	Mach. eff'cy of loco., per cent
56.4	13,691	2,960.2	3.5	20.0	89.5
56.4	5,201	782.6	2.6	23.8	77.4
46.9	17,293	2,162.3	3.8	20.6	93.8
75.0	10,129	2,026.4	2.9	20.5	86.0
Second Test, December, 1914					
55.7	4,819	716.4	2.8	24.9	70.5
55.7	14,297	2,125.3	3.2	19.8	89.8
55.7	15,138	2,250.4	3.8	19.8	90.4

The maximum drawbar or dynamometer horsepower obtained was 2250.4, with a coal rate of 3.8 lb. per dynamometer horsepower hour and a steam rate of 19.8 lb. The coal rate for all tests was generally below 3 lb. Locomotive No. 51 developed a maximum dynamometer horsepower about 17 per cent greater than that of No. 89. The machine efficiency ranged between 59.3 and 96.2 per cent, being higher for locomotive No. 51 than for No. 89. The thermal efficiency ranged between 3.8 and 7.8 per cent, being higher for No. 51 than for No. 89, because of the better boiler performance of the former. This is shown in Fig. 7.

In the curves showing steam per dynamometer horsepower hour, Fig. 8, No. 51 is shown to develop a maximum horsepower which is 17 per cent above that of No. 89, while the steam rate is slightly lower than that of No. 89. In the coal rate, No. 51 has a considerable advantage over No. 89 at all horsepowers, as shown in Fig. 9. Fig. 10 shows dynamometer horsepower on the basis of dry coal fired per hour. It is evident from the curves that No. 51 has a decided advantage over No. 89, the horsepower being greater at all rates of firing. When the firing rate is 7,000 lb. per hour, the horsepower developed by No. 51 exceeds that of No. 89 by 250, or 13.5 per cent.

In the curves of drawbar pull, Fig. 11, the advantage of the larger cylinders of No. 51 is in evidence, a greater drawbar pull being maintained by this engine at every speed up to 85 miles an hour.

An interesting feature of the drawbar pull tests is shown in Fig. 12. The straight lines show the drawbar pull at the various cut-offs given, and indicate a falling off in pull as the speed increases. It is believed that this effect is due to losses of pressure in the cylinder as the piston speed increases.

Conclusions

These tests are indicative of what can be accomplished by careful study in the designing of locomotives, and the

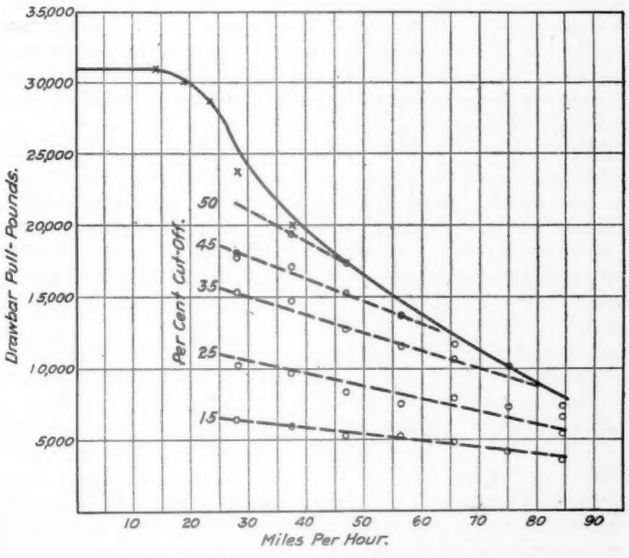


Fig. 12—Maximum Drawbar Pull at Various Points of Cut-Off

advantages to be obtained by the co-ordinate use of a testing plant therewith. When No. 89 was equipped with a superheater it was reasonable to expect that the engine represented the highest development in the way of power production in locomotives of this type. But the further improvements made—increasing the length of tubes and the size of the cylinders—provided a locomotive which has developed a maximum indicated horsepower of 2488.9 at a speed of 56 miles per hour—a horsepower for each 96.4 lb. of total weight and for each 53.4 lb. of weight on drivers—and a maximum drawbar horsepower of 2250.4, at a coal rate of 3.8 lb. and a steam rate of 19.8 lb. per drawbar horsepower hour. Thus, a substantial improvement in the economy of the locomotive was secured, together with an increase of over 20 per cent in the maximum drawbar horsepower delivered.

It is seen that, to the owners of this equipment, such tests bring a return, in increased power and economy throughout the life of the locomotive, many times greater than the cost of the design study and test plant operation.

As described in this review, the determination of the funda-

mental proportions of the boiler and engines must often be made within close differences requiring means of making tests in which the conditions can be duplicated as exactly and as many times as need be, and since conditions in service make such duplication in tests on the road impossible, the suggestion would seem to be, particularly to those not well equipped for selecting and trying out their locomotives, that the locomotive testing plant furnishes the only means for the solution of problems of this character.

TRAIN RIGHTS FOR SMALL MOTOR CARS

By E. E. Bradley
Signal Engineer, Western Maryland

The Western Maryland is a single-track road in a mountainous territory, and has heavy grades and curvature. passing over many bridges and through tunnels of great length, making operating conditions difficult; and when automatic signals were installed, the signal maintainers were furnished gasoline motor cars to get over their sections. It was not considered safe for motor cars to move over main tracks except under protection of train orders, although with the absolute-permissive scheme of single-track signaling in use, it was possible at times to operate the cars with considerable safety by signal indication. All motor cars are run as extra trains by train orders from the despatcher, and by rule, and all persons whose duties require them to operate motor cars are required to pass the regular examinations: physical, including color blindness, book of rules, time tables, movement of trains by train orders, and the physical characteristics of the road over which they run their cars.

Motor cars leave their initial stations as extras, displaying proper classification signals and markers as required by rule, having meeting points fixed by train orders against all opposing trains of the same class and wait orders on opposing second-class trains; and they clear the time of first-class trains as required by rule. When overtaken by extra trains moving in the same direction, the motor cars let them pass as soon as it can be done, which means at the first switch they come to.

When doing work requiring from two to three hours on a district, such as filling lamps, making up batteries, etc., a form of order is used in which opposing extras are directed to wait at certain stations until times named.

The men are delayed at times waiting for trains on which they have meets, and, of course, a car is subject to delays caused by unexpected delays to freight trains to which it is inferior. The average delay for each maintainer waiting on orders, making meets with trains and from other causes will average about 1½ hours a day. When this practice was begun it was questioned whether or not the delays would seriously interfere with necessary maintenance work. To a certain extent they have, but this is largely offset by the increased safety provided by train order protection.

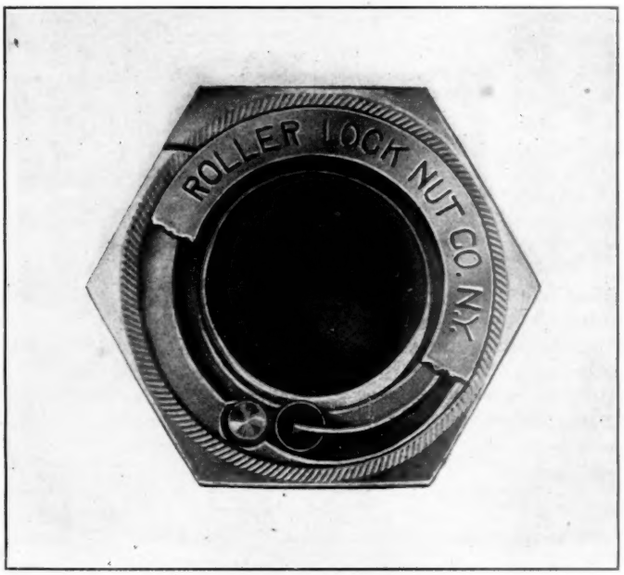
It was decided that the warning device to be used on these cars should be distinctive. A horn would not do as it might be confusing to men working on the track; they would very likely think it a passing automobile and not heed the warning. Also, an automobile approaching a grade crossing and hearing a horn would naturally mistake the horn for another automobile instead of looking for anything on the railroad. So each car is equipped with an eight-inch trip gong, and operators of the cars are required to give ample warning when approaching any point where warning is necessary. Each car is also numbered the same as engines, the numbers being five-inch white enamel figures on a black background, displayed on both front and rear of the cars.

Telephones for train despatching are used almost exclusively and signalmen take their orders direct from the despatchers, except at offices where operators are on duty. In addition to the telephones at stations and block offices, there are telephones at each end of passing sidings, in watchmen's boxes, and at other convenient places along the line, and also in signal maintainers' tool houses, where located some distance from offices, so the signal maintainers can get their orders before leaving headquarters.

No one is allowed to go out alone with a motor car. Each maintainer is given an assistant and they always go together, and they are responsible for all signaling apparatus on their sections. This plan works out very well, as it is not only good schooling for the assistant, which prepares him for promotion, but also provides a flagman for the car when necessary.

ROLLER LOCK NUT

A new type of lock nut of unique construction has been placed on the market recently. It has a small roller which operates in the annular space on the outer face of the nut, being held in position by a band, as shown in the illustration. This roller acts between the threads on the bolt and against the cam-shaped surface in the annular recess of the nut. It is covered by a tool steel retaining ring, part of which is cut away in the illustration to show the construction of the nut. As this nut is screwed on to the bolt, the roller will ride between the threads, offering no resistance whatsoever. As the nut



Roller Lock Nut

turns in the opposite direction, however, the roller will jam in between the threads and the cam in the nut, preventing it from working off the bolt. To remove the nut, a sharp, quick twist is given the nut by an ordinary wrench. This forces the roller over into the recess just ahead of the cam. With the roller in this recess, the nut is easily removed. As soon as the nut has been removed from the bolt the roller returns to its original position and the nut is ready for reapplication.

The principal advantages of this type of lock nut are that with any vibration or working in service it is free to tighten up, but cannot turn back, and therefore tends to become tighter with recurring vibration. The bolt to which it is applied does not need to be any longer than one used with an ordinary nut without a washer or nut lock. This device has been in test service for a period of over two years. Two railroads have made extensive trials of the nut in track and on rolling stock. Tests are now in effect on the New Haven, the New York Central, the Central Railroad of New Jersey, the Pennsylvania, the Lehigh Valley and the Erie. This lock nut is manufactured by the Roller Nut Lock Company, New York.

Electrical Night of the New York Railroad Club

The Norfolk & Western and the St. Paul Electrifications Were Discussed From an Operating Viewpoint

THE New York Railroad Club held its thirteenth annual Electrical Night on Friday, March 16, 1917, at the Engineering Societies building, New York. C. H. Quinn, chief electrical engineer of the Norfolk & Western, addressed the club on the operating features of the Norfolk & Western electrification*. R. Beeuwkes, electrical engineer of the Chicago, Milwaukee & St. Paul, had planned to discuss the operating features of the St. Paul† electrification but was suddenly called out of town. His paper was, therefore, read by A. H. Armstrong of the General Electric Company. Both papers were illustrated by lantern slides and moving pictures.

THE NORFOLK & WESTERN

By C. H. Quinn

The first part of Mr. Quinn's paper discussed the operating and physical characteristics of the Pocahontas division of the Norfolk & Western for the purpose of showing how they influenced the consideration of electrification as a means of increasing the capacity of this part of the line. A large part of this information as well as a description of the engineering details of the electric system installed has been published in previous issues of the *Railway Age Gazette**.

In 1906 the annual gross business in one direction, represented by a net ton haul, eastbound, was 279,933,339 ton miles. In 1916 this business had increased to 592,597,018 ton miles, or 110 per cent. The roadbed and alignment, as well as motive power and equipment, necessarily had to keep pace with this growth of traffic.

In 1910, the railroad took up the consideration of using electricity on this section of the Pocahontas division. To insure that the proposition should be approached from every angle the study of the situation was taken up with the purpose of deciding whether or not the results could be reached by the use of the steam locomotive in conjunction with a new location or other changes in the present right-of-way. The result of this survey was the development of a profile and alinement which necessarily included a new tunnel 2.5 miles long, with a grade of eight-tenths of one per cent against the traffic. Owing to the ruling grade of 1.4 per cent approaching this tunnel, as well as its extreme length, its successful operation would require the use of an electric locomotive. The slower and uncertain movement of the steam handled trains on either side of the tunnel approach would not entirely eliminate the sluggish movement, in both directions, of the freight traffic as a whole. The net returns from such an investment would be relatively small. It was also found that there would be only a small difference in the total first cost of such an installation as compared with the first cost of the electric motive power and equipment as we are now using it.

Electric operation was started January 1, 1914, and the resulting increase in speed of the tonnage trains up the grade, from 7 to 14 miles per hour, as well as the prompt handling of these trains through the Elkhorn tunnel, immediately keyed up the entire traffic moved over this grade. It has been found that the electrically handled coal trains can keep out of the way of any steam movement in the same direction on the grade with the exception of two through passenger trains. For this reason the delay formerly incurred when clearing local passenger and time freight trains has been eliminated. Further than this, the absence of delays incident to the taking on of coal and water for three steam locomotives has not only materially reduced the running time, but has cut out delays to other trains.

The unqualified success of the regenerative braking of these locomotives has practically eliminated the use of the air brakes for the governing of train movement down the grade. The use of retaining valves for the purpose of braking trains on grades under electric operation is unknown. It is to be regretted that a definite money value cannot be placed on the benefits derived from electric braking. To appreciate this feature one must be familiar with some of the operating difficulties in successfully handling a 90-car train on a two per cent grade with air brakes. The elimination of broken knuckles, trains breaking in two and other incidental delays due to difficulties with the air brake equipment on long trains, are some of the benefits obtained by regenerative braking.

The improvement in the movement of coal tonnage trains has resulted in a marked reduction in the time required to get these trains over the road. Under steam operation, the average miles per day would approximate 60 per locomotive. This mileage, with the electric locomotive, has been increased to 100, with only a slight increase in time in service per day for the engine crew. The short terminal layover for the electric locomotives, which averages 45 minutes per locomotive, practically permits us to double crew these locomotives every 24 hours. As a direct result, the number of locomotives handled out of Bluefield has been reduced from seventeen steam to five electrics. The number of pusher engines has been reduced from seven steam locomotives to two electric locomotives.

Electric locomotives during zero weather operate at practically full tonnage rating, while the steam engine always requires a tonnage reduction in cold weather. Further than this, the terminal attention and terminal equipment required for the electric locomotive is conspicuously less than that needed to take care of steam power. In freezing weather the difference is even more pronounced than at other times. The absence of coal wharves, cinder pits, water tanks, round houses and turntables incident to the terminal handling of steam power is an economical and interesting feature. At Bluefield, where the electric locomotives change crews, the terminal facilities consist of a 60-ft. open pit; a one-story wooden structure 14 ft. by 36 ft., with a small building in which is carried a supply of lubricating oil, and another for the storage of dried sand.

Traffic Records

The following extracts from the records of the train sheets, as well as the data collected from the car record office verify the wisdom of the railroad in its decision to use electric motive power. The figures compare the traffic during the year 1914 under steam operation and during the year 1916 under electric operation.

The maximum eastbound tonnage for any 24-hour day handled by steam locomotives amounted to 51,226 gross tons; by electric locomotives, 59,543 gross tons, or an increase of 16 per cent. The maximum number of loaded eastbound cars per day handled under steam operation amounted to 675; with electric locomotives, 757 cars. The maximum number of locomotives in use to handle the heaviest day under steam operation was 43; with electric operation, nine. The total number of loaded cars handled eastbound during the year 1914, under steam operation, amounted to 132,618,

Railway Age Gazette, June 4, 1915, Vol. 58, No. 23; Feb. 25, 1916, Vol. 60, No. 8.

†*Railway Age Gazette*, Dec. 18, 1914, Vol. 57, No. 25; Oct. 15, 1915, Vol. 59, No. 16; April 28, 1916, Vol. 60, No. 17.

while in 1916 with electric operation, the number was 165,689; an increase of 33,071. This shows a 25 per cent increase.

To handle the business with steam locomotives during the year 1914, as covered by the above figures, required a total of 93,625 engine-hours. To handle 25 per cent more traffic in 1916 with electric locomotives required a total of 44,112 engine-hours, a reduction of 48 per cent.

The total ton-miles eastbound during 1914 amounted to 457,163,921. A similar figure for the year ending December, 1916, shows 592,597,018, an increase of 135,433,097 or approximately 30 per cent. With an assignment of 25 Mallet locomotives to handle the business during 1914, the increase in active power to take care of the average tonnage in 1916 would have required the assignment of eight additional steam locomotives to this service, making a total of 33. If the tonnage handled on the maximum day with the electric locomotive is considered, it would have been necessary to have further increased the number of steam locomotives in this service to 42. Under the limited speed and track conditions with steam operation, it is doubtful whether this volume of traffic could have been successfully handled, if only for one day of 24 hours. The maximum number of electric locomotives in service was nine, and the average seven.

In general the cost of the electrification does not much exceed the value of the physical improvements to the roadbed and right-of-way which would be necessary to put this division of the railroad in a position to handle additional traffic with steam locomotives. The operating cost of the electric system is well within the original estimate. The production of energy in the steam power plant has more than passed expectations. The ability of the electric locomotive to stand up under the heavy and exacting duties in pusher service, requiring the use of full power to hold the train slack while at a standstill and to handle its rated tonnage according to the specifications under which they were purchased is being demonstrated in every day service.

The present rating of the electric locomotives, after being in use for two years, is identical with the figures quoted in the contract. The electric locomotive has given more engine miles per 24 hours than was expected. The operation of the electric transmission system, the sub-stations and the overhead contact wire has been entirely successful. The general operating improvement as described, coupled with the traffic data can only indicate that the electric locomotive service on this portion of the Pocahontas division has not only increased the capacity of the track at least 100 per cent, with a conspicuous reduction in operating costs, but is likewise paying a return on the net cost of the installation. Putting this in different language it is considered that the installation is an engineering, an operating and a financial success.

As a further evidence of the value of this installation as a factor in the development of the railroad necessary to handle an increasing volume of business, we have authorized and have under construction the electrification of an additional 11 miles of double track main line, and 12 miles of branch line. The authority includes the purchase of additional locomotive equipment as well as sub-station and power house apparatus to take care of the increased load requirements.

To give a better understanding of the business policy governing the Norfolk & Western in adopting this type of motive power, it should be stated that the railroad is still considering the further development and improvement of its steam locomotives. The field of activity of the electric locomotive should naturally be confined to sections of the road where the profile and tonnage handled will permit the economical use of this type of motive power. There are other sections of the road where the maximum possibilities of the steam locomotive have not as yet been reached, and where we are still able to operate them economically as compared with the returns from an investment which would be represented by the use of the electric locomotive. With the commercial value of the steam locomotive well understood under such conditions, the next development in this direction will probably be the design and building of a Mallet locomotive with a tractive effort of approximately 104,000 lb. for use in main line service over 100-mile divisions of the road.

In conclusion, it would seem fair to prophesy that the use of electric locomotives in congested sections of the railroad, for the movement of heavy tonnage over grades requiring pusher service, is here to stay, and that its extended use in this class of service will be general in the not very distant future.

OPERATION OF THE C. M. & ST. P.

By R. Beeuwkes

The figures given in Table I. apply to the Rocky Mountain division only as we have not been running long enough on the Missoula division to get similar data. On this division we have been handling 3,000 ton trains as a standard through the worst winter months and the entire operation is working out successfully. Although the figures for electric operation are very favorable, it should be remembered that they can hardly as yet be considered final, because the steam figures represent the results of many years of effort and experience, while those for electricity are based on the use of apparatus, entirely new in important respects, and on an operating experience of less than a year.

With regard to the operating organization, substation operating forces and line and locomotive maintenance forces have been added, but otherwise, no change has been made in the original steam organization and personnel, except in the way of reduction, as will be described. This includes the engineers and their helpers on the locomotives. The change from steam to complete electric operation was made in the course of a few months with remarkable facility, its rapidity being governed entirely by the rate at which the manufacturer was able to supply the electric locomotives. The instruction of the engineers was done by having four or five General Electric men on the ground who had assisted in testing the locomotives at the works and who were thoroughly familiar with the electrical details. These men spent all their time for some months riding the different locomotives and explaining their electrical operation to the engineers, this being done on trains in regular operation.

Harlowton, Mont., is the eastern terminus of the Rocky Mountain division and the station where electric operation begins. Here are located the usual roundhouse facilities, a portion of which has been partly reconstructed to accommodate the electric locomotives. Three Forks, Mont., separates the division into the east and west subdivisions, and was a former steam locomotive division point. Deer Lodge, Mont., is the western terminus of the Rocky Mountain division.

Under steam operation train engines were changed at Deer Lodge, Three Forks and Harlowton. Thus, a steam locomotive made about 113 continuous miles. At the end of that run it was put in the roundhouse or shop, to have the boilers cleaned, washed, etc., and for any light repairs. Heavy repairs were made at Deer Lodge. This necessitated a large roundhouse and shop force at each of the three above mentioned points. Freight trains were tied up in the yards and there were the usual other costly and vexatious delays. All train and engine crews changed at each of the through subdivision points mentioned except passenger train crews which ran from Deer Lodge through to Harlowton. Under steam the cabooses and many of the engines were assigned which, of course, made it necessary to take the caboose from the train at each subdivision point.

With the introduction of electricity we were able to double, the cruising radius of our locomotives. As far as the railroad is concerned we have eliminated Three Forks entirely. All locomotives run the entire 226 miles from Deer Lodge through to Harlowton, with only a very light inspection of bearings and pantographs at Three Forks. The shop and roundhouse are entirely closed down, seven or eight miles of tracks have been removed and the comparatively large roundhouse force previously employed has been replaced by a single electrician. All locomotives and cabooses are pooled, the men being given suitable locker space to store their lanterns, flags, tools, etc. Through freight trains do not leave the main track and often are not switched at all. At Harlowton the locomotive is given a rough inspection and any light repairs made that are necessary. Detailed inspection and maintenance work is done at Deer Lodge. The same change in operation has been effected on the Missoula division, Avery to Deer Lodge, in this case Alberton being the steam engine division point eliminated.

Under present conditions, we are running with a monthly load factor—ratio average load to maximum load—of about 40 per cent, but expect within a few months to have installed a so-called power indicating and limiting system, which will automatically indicate to the despatcher the exact amount of power which the whole system is drawing at any instant and will automatically within certain limits hold the maximum down to a certain pre-determined amount; this with the object of keeping as low as possible the maximum amount of power which we have to contract with the power company to furnish and on basis of 60 per cent of which amount, so contracted for, our minimum power bill is made.

The figures given in Table I show, for the Rocky Mountain division, a comparison of locomotive performance for October, November and December under steam operation in 1915 and electric operation in 1916. It should be understood that the figures given, while sufficiently correct for comparative purposes as they are taken from the same report forms are not to be considered as strictly accurate when considered individually. The forms are those from which the data could most conveniently be obtained in the short time available.

TABLE I—DATA ON OPERATION UNDER STEAM IN 1915 AND UNDER ELECTRICITY IN 1916

	Rocky Mountain Division. Passenger.	October.		November.		December.		Total.	
		Steam.	Elect.	Steam.	Elect.	Steam.	Elect.	Steam.	Elect.
1	Train or Train Engine Miles	39,426	40,169	41,276	40,549	38,628	38,519	119,330	119,237
2	Helper Engine Miles	4,738	.....	7,966	.....	12,048	.....	24,752	.....
3	Number Engines	13	7	13	7	13	7	13	7
4	Train Miles per Engine	3,040	5,730	3,180	5,800	2,970	5,510	9,190	17,040
5	1,000 K.W.H. at Power Co.'s Meters	.....	1,217	.....	1,109.5	.....	1,152	.....	3,478.5
6	K.W.H. per Train Mile	.....	30.3	.....	27.4	.....	29.9	.....	29.1
7	Coal, Total Tons	3,380	.....	4,150	.....	3,730	.....	11,260	.....
8	Coal, Lbs. per Train Mile	171	.....	201	.....	193	.....	188	.....
	Freight.								
9	1,000 Ton Miles	98,512	125,522	93,228	130,848	91,122	107,717	282,862	364,087
10	Train Miles	60,666	65,400	58,014	63,299	58,257	57,311	176,937	186,010
11	Helper Engine Miles	16,605	7,022	20,422	7,544	19,336	5,591	56,363	20,157
12	Number Engines	42	15	41	15	44	15	43	15
13	1,000 Ton Miles per Engine	2,405	8,370	2,270	8,720	2,070	7,170	6,745	24,260
14	*Number Subdivision Trains	535	585	523	583	586	543	1,584	1,711
15	†Ton Miles per Train Mile	1,625	1,920	1,605	2,070	1,563	1,880	1,600	1,960
16	Total Time, Hours	6,094	5,022	5,946	5,084	5,785	4,429	17,825	14,535
17	Minutes per 1,000 Ton Miles	3.70	2.40	3.83	2.33	3.81	2.47	3.78	2.39
18	1,000 K.W.H. at Power Co.'s Meters	.....	4,696	.....	5,119	.....	4,528	.....	14,343
19	K.W.H. per 1,000 Ton Miles	.....	37.4	.....	39.1	.....	42.0	.....	39.4
20	Total Tons Coal	12,150	.....	13,670	.....	13,230	.....	39,050	.....
21	Lbs. Coal per 1,000 Ton Miles	247	.....	294	.....	291	.....	276	.....

* Subdivision Train—One train over one Subdivision: Divide by 2 for trains over entire Division.

† Ton Miles per Engine—Mile equals tons per train with one electric engine and short helper service, or with one steam engine and longer helper service: In this connection consider Item 17. Total Regeneration over entire Division, Month of November, equals 11.3% of consumption at motors. Passenger on 2% grade, Jan. 21-27, 1917. — Regeneration — 42.8% of consumption at motors. Passenger on 1.66% grade, Jan. 21-27, 1917. — Regeneration — 23.1% of consumption at motors.

Passenger Data

Taking first the passenger data: As already described, passenger service on this division consists of two through trains each way daily and one local each way. The local ran between Deer Lodge and Harlowton during one part of these three months and between Butte and Harlowton during the remaining part. This and the running of special trains accounts for the slight variation in train miles of Item 1. It will be noted that the "Total" miles under steam and electricity were almost exactly the same.

Item 2. Helper Engine Miles. This increased under steam as the temperature decreased, but this service with its extra crew cost, switching delays, etc., has been eliminated under electricity. It should be noted that the figures given do not contain any allowance for return trips of helpers down the mountain.

Item 3. Number Engines. This is the number actually assigned to this service, both on the road and in shops, by the district master mechanic. The electric locomotives include five double units and two split locomotives and the number can probably be reduced when train heating apparatus is gotten into shape and minor electrical improvements completed, which matters have required more shopping than will ultimately be necessary. The number of steam engines, on the other hand, is a minimum as freight engines in helper service were often used to help passenger trains, a fact which is not taken into account in the figures shown. Therefore, less than half as many electric as steam engines are required for the same service.

Item 4. Train Miles per Engine. This is derived from the preceding figures and, on basis of what has just been mentioned, the figures are high for steam and low for electricity. Our record for an electric locomotive is 9,052 miles made in June, 1916.

Item 5. This shows the actual electric energy purchased and chargeable against this service. Every electric locomotive is equipped with a kilowatt hour meter, which on each trip is read at points of commencement of motoring and again at commencement of regeneration, giving a record of the engineer's performance as regards use of power. The figures shown in the table are the net energy read at the locomotive increased by a suitable amount for line and substation losses. The efficiency of the system from the power company's meters to locomotives is now running at 67 to 70 per cent.

Items 6 and 7 are self-explanatory. The coal figure is only approximately correct.

Freight Data.

Item 1. This shows an average increase during the months of electric operation of 28.8 per cent over that of steam. For November the increase was 40 per cent. In this connection the superintendent of the division has stated that to handle the 1916 business either electrification or, with

steam, double tracking would have been necessary. The latter would still, of course, have required extra motive power. Possibly, the superintendent did not intend his statement should be taken literally, but, in any event, it is reasonable to assume that under the business conditions which existed during the months under electrical operation, the steam figures would be for steam too favorable.

Item 10. Train Miles. This is used in obtaining Item 15.

Item 11. Helper Engine Miles. The figures show that for the same ton miles there would be over three times as many helper engine miles under steam as under electricity. No account is taken of the return trips of helpers or their otherwise running light. This is a considerable item under steam, but is small for electricity.

Item 12. Number Engines. This is possibly a little high for steam because some of these engines were at times used in passenger helper service as already explained. The number of electric locomotives given is the number purchased for this service and is considered sufficient. We are unfortunately obliged to use our judgment in this matter as many of the locomotives purchased for the Missoula division, not then under electrical operation, were available and used. Twenty-eight locomotives are now easily handling the business of the two divisions.

Using the figures as they stand and deducting Item 13—1,000 Ton Miles per Engine—we find that the electric locomotive handles about three and one-half times as many ton miles per month as the steam locomotive and from item 17 Minutes per 1,000 Ton Miles—that the electric locomotive cuts 30 per cent from the time necessary to handle a given business, partly by faster running, partly by heavier trains.

Item 14. Number Subdivision Trains. This shows for the three months, that the average number of division trains involved was 8.6 for steam and 9.3 for electricity.

Item 15. Ton Miles per Train Mile. This is about the same as tons per train, and 22 per cent greater for electricity than steam. The electric train, it might be considered at first glance, ought by comparison to be heavier, but it should be remembered that the steam train during a considerable part of the time had two locomotives on it. The tonnage of the through freight is greater than shown, the average figures shown being considerably lower because the comparatively light local freights were included.

Items 18 and 19, showing consumption of electric energy, are derived in the same manner as previously described for passenger service and later in conjunction with Items 20 and 21 give a comparison of relative amounts of coal and electricity used to handle a given business. Under present conditions we are paying for electricity on a k.w.h. basis and it is costing considerably less than was formerly paid for coal.

The effects of regeneration on the power consumption vary more or less, but it will be noted that for the month of November, the amount of regenerated power measured at the locomotives was 11.3 per cent of the total power consumed at the motors. Some of this power goes over the trolley direct to locomotives which are motoring, and the rest goes through the substations, reversing the motor generators and either flowing into the power company's transmission system or along the railway line to other substations.

The power saving feature of regeneration is not considered so important as the increased safety and ease with which trains are handled on the heavy mountain grades and the saving in wear and tear on brake shoes and equipment.

ANOTHER CHINESE RAILROAD CONTRACT.—Award of a contract for construction of a 200-mile railway in China by the Siems-Carey Railway & Canal Company, of St. Paul, has been announced in a dispatch from the American legation in Pekin. The line will run from Chowkia-Kow to Siang-Yang.

VALUATION HEARING BEFORE INTERSTATE COMMERCE COMMISSION

Hearing of the protests by the carriers against the tentative valuations served by the Interstate Commerce Commission in the cases of the Kansas City Southern, New Orleans, Texas & Mexico and Winston-Salem southbound railways, together with some additional testimony on the cases of the Atlanta, Birmingham & Atlantic and Texas Midland, was begun on Monday before the full membership of the Interstate Commerce Commission at Washington, and two weeks has been set aside for the hearing. After considerable discussion of the plan of procedure, it was decided that all testimony presented should apply to all of the cases involved, except as it should be stipulated in connection with any part of the testimony. S. W. Moore, general solicitor of the Kansas City Southern, said his road did not wish to be bound in advance by testimony as to the other roads. The western group of railways was represented by Pierce Butler and Leslie Craven, the eastern group by George Stuart Patterson and Sanford Robinson and the southern group by W. G. Brantley. The state commissions were represented by C. B. Aitchison and A. E. Helm. Glen E. Plum entered an appearance on behalf of the brotherhoods of train service employees.

Mr. Butler stated that he would like to examine Director Prouty of the division of valuation as to certain features of the tentative reports and immediately precipitated an animated discussion by asking whether the tentative valuation of the Texas Midland was prepared by the division or by the commission. Mr. Prouty replied that the tentative valuation as served was the act of the commission, that any communication between the division and the commission was privileged and ought not to be inquired into. P. J. Farrell, solicitor for the division of valuation, objected to the question, saying that the carriers have a right to inquire into the correctness of the tentative valuations, but not as to who did the work. He said the forces of the division were working under the commission and that after the commission served the notice it became the action of the commission. Mr. Butler said he wanted the record to show that the valuation as served was prepared by the division and more particularly by the director and adopted pro forma by the commission.

Chairman Hall asked what bearing that fact would have if it were so. Mr. Butler said its standing in court would be affected by the question whether or not it represented the judgment of the commission. Commissioner Clark asked whether he thought the commission had not given it consideration. Mr. Butler said he had understood the director to say that he had drafted the report. Mr. Prouty said that if he had made any such statement it was not true and that, as a matter of fact, the commission had considered the report very carefully. Commissioner Clements explained that the commission had complied with the law and that the carriers now have the opportunity to protest against and introduce evidence as to any point of law or of fact, that the report came to the commission like the report of an examiner in a rate case which might be modified by the commission before being made final, might be reversed or might be adopted when approved. When once adopted it represents the action of the commission, but under the law the roads have an opportunity to show cause why it should not be adopted as final.

Mr. Moore said that if the report had been perfunctorily adopted by the commission, it would not be the tentative valuation required by the law and that the carriers wanted to know whether it represented the results of the deliberation and consideration by the commission. He thought the commission before promulgating the tentative valuation should have determined some rules, principles and methods. Commissioner Clark wanted to know in what way the commission could be expected to do the work except through the division

of valuation. Chairman Hall ruled that the tentative valuation is a public record representing the action of the commission and that there is no right to go back of it and, therefore, sustained the objection to the question and answer.

Mr. Butler then asked whether the division in reporting that "no other values or elements of value were found to exist" meant to find as a fact that there were no such values or to express no opinion on the point. Mr. Prouty said that he had written to Mr. Wells of the Texas Midland, stating that he might file a claim as to such elements of value and that he did file certain claims, and he had told Mr. Wells that he might introduce testimony on the point, but he had not yet done so. Mr. Prouty thought that if the carriers had testimony that would establish other elements of value it should be presented to the commission. Solicitor Farrell objected to the question and Chairman Hall sustained the objection, saying that the tentative report speaks for itself. Commissioner Clark said he thought the finding in the report was clear. Mr. Butler asked if the commission had looked for any such elements of value. The chairman stated that the opportunity is given to the carriers to introduce testimony on that point.

Mr. Butler then asked the director if he thought 6 per cent a reasonable and sufficient rate by which to compute interest during construction in the case of the Texas Midland and to cover the cost of obtaining money over and above interest. Solicitor Farrell objected on the ground that the director had not been called as an expert witness on this point and the objection was sustained.

E. T. Lamb, president of the Atlanta, Birmingham & Atlantic, testified regarding the other values and elements of value, pointing out the following as among such elements to be considered: Going concern, franchises, location and gradients, favorable contracts, the right to use properties not owned, facilities used by it provided by non-carriers and other carriers, continuity of land, a completely organized and equipped property, other costs of construction and development than those reported. Chairman Hall said the witness had stated that there are such values, but did not prove what the values are. Judge Brantley, asked if the commission could not eliminate the statement that other values or elements of value were found to exist and substitute a statement that certain values were found, including an amount therefor, if the commission decided to make a specific valuation, and, if not, to state the facts so that a court or whoever fixed the final value could be given an opportunity to place a figure thereon.

Charles E. Rice, a lawyer of Birmingham, Ala., gave testimony regarding the development and growth of population.

At the hearing on Tuesday E. Holbrook, special engineer of the Union Pacific; W. H. Courtenay, chief engineer of the Louisville & Nashville, and J. E. Willoughby, chief engineer of the Atlantic Coast Line, testified regarding the appreciation in value of railroad track due to seasoning and solidification. Mr. Courtenay gave figures for various new lines built by the Louisville & Nashville, showing the added cost of maintenance on new line, as compared with older lines on the system. He gave the following differences per mile per annum for the increased labor cost alone, excluding rail and tie renewals, for various new lines, as compared with old lines, $897, $1,093, $947, $1,534 and $421. The decreased labor cost on a seasoned line, he said, represented only a part of the appreciation. On a new road derailments are frequent, sometimes as frequent as one a day, which cause damage to track and equipment as well as to lading, and add to the expenses of operation. He said the value of appreciation due to age can only be approximated and he hardly thought it could be stated in dollars and cents, but he thought that a fair approximation could be obtained by taking 25 per cent of the cost of reproduction of the roadbed for the difference between the seasoned and the new line. He cited the experience on two divisions on which tests had showed that on a new line three less cars per train can be operated than on another line with a grade .05 per cent less. Mr. Willoughby mentioned as factors in the value of appreciation the lessened cost of maintenance, greater speed and tonnage of trains and reduced hazard. He said he had made some studies of the matter and, while it could not be expressed in exact figures, he thought seasoning should add 25 per cent to the value of the roadbed.

The Elgin, Joliet & Eastern and Chicago, Lake Shore & Eastern have filed protests with the Interstate Commerce Commission against the tentative valuation of their property served recently by the commission. The Illinois Public Utilities Commission also filed a protest against certain features of the report.

A. B. & A. Hearing at Chattanooga

A hearing on the protest of the Atlanta, Birmingham & Atlantic regarding the tentative valuation of its property issued by the Interstate Commerce Commission was taken at Chattanooga, Tenn., on March 1, before C. F. Staples, member of the advisory board of the division of valuation, who has had active charge of the valuation of the Atlanta, Birmingham & Atlantic. The railroad was represented by W. G. Brantley as counsel and E. M. Durham, Jr., special engineer. The testimony was devoted principally to the question of classification of land and unit prices. The informal objections and exceptions of the carriers to the valuation had been submitted to Mr. Staples with other members of the division of valuation and presumably overruled, as the tentative valuation served by the commission is in the same form as it was when the exceptions and objections were first informally made. This prompted the carrier at the hearing to submit a formal motion to be advised as to the power and authority of the examiner and, particularly, as to whether the examiner had been given power to report findings of fact and conclusions upon the testimony submitted.

Testimony regarding the classification of land developed that in some instances where the carrier had purchased land for section house purposes, which was used for cultivation by section hands, it has been classed as non-carrier property. In a number of cases part of the station grounds of the carrier, occupied by seed houses, was classified as non-carrier. Property acquired in Atlanta and Birmingham for freight station purposes and which was admitted to be well selected for that purpose was excluded from the carrier lands because not actually used at the time. Some lands acquired by condemnation were classed as non-carrier, although the laws of the state of Georgia require the carrier to show its need for such lands before it can be condemned. In some cases lands purchased for terminal purposes were classified as non-carrier, although since the date of valuation plans have been practically completed for the use of such lands. Testimony was introduced to show that the zone system used in valuing lands included land varying in value from $2.50 to $75 per acre in the same zone. Farm land, wood land, swamps and residential property in small towns had also been placed in the same zone.

Coal Supplants the Kaoliang Stalks of Manchuria.—The South Manchuria Railway Company, which owns the Fushun coal mine, is making every effort to encourage the use of its coal instead of kaoliang stalks by the Chinese in this district. The kaoliang is a species of tall millet grown throughout Manchuria. The grain is used as food and is also largely used in the production of samshu, an alcoholic drink that is consumed in large quantities by the Chinese. The kaoliang stalks are a valuable by-product and are employed in the building of houses and fences, as well as for fuel. They are both cheap and abundant and have hitherto competed successfully with coal.—*Commerce Report.*

General News Department

The Boston & Maine has increased the pay of its telegraphers and granted them an annual vacation of one week.

The United States Civil Service Commission announces examinations April 17 for the position of senior land appraiser for the Interstate Commerce Commission; salaries, $1,800 to $2,700. Applicants must be between 25 and 50 years old.

The Barren County Circuit Court at Glasgow, Ky., has fined the Mammoth Cave Railroad $500 for violation of the law requiring separate compartments or cars for white and colored passengers. The Mammoth Cave road runs between Glasgow Junction and Mammoth Cave, 9 miles.

The telegraph operators and agents of the Chicago & North Western, have effected a settlement of their demands for wage increases, the company granting an increase of about 9 per cent. This will affect approximately 2,000 telegraphers, station agents and tower men, and means an increase in the company's payroll amounting to $150,000 annually.

New Jersey Full Crew Law Modified

The legislature of New Jersey, which has had under discussion for several weeks a bill to repeal the "full-crew" law of that state, finally adopted it, with an amendment, on Tuesday last. The lower house had defeated the repeal; then, after a long contest it was carried, by a vote of 37 to 22. In the Senate, however, a change was made so that the railroads will have to file complaints with the Public Utility Commissioners if they wish to show that the trains at present are over-manned; and the burden of proof will be on the railroad company to prove that such is the case. It is expected that the governor will give public hearings before approving the bill.

Daylight Saving

The National Daylight Saving Committee announces that a proposal to enact a federal daylight saving law, providing for setting clocks forward one hour, will be laid before the coming extra session of Congress; and it is declared that 61 out of the 96 senators; and 294 representatives are favorable to the proposed law. Colgate & Company, soap makers, Jersey City, N. J., tried the plan last Summer, and it is said that about 90 per cent of the concern's employees are in favor of repeating the experiment this year. The directors of the Boston Chamber of Commerce have accepted a favorable report on daylight saving and are considering the question of recommending the scheme for perpetual use, both summer and winter.

Old-Fashioned Ticket-Agent Still Living

To all the presidents, and the vice-presidents, of all the railroads, in the whole world. Gentlemen: Someday, I want you to go, each one of you, into a ticket office, where they don't know you, and go up to the counter, and stand there, and look at the man behind the counter. And lean there against the counter and watch him, and stand there, and look at the man, and watch him, and try to grab him when he gets near you; and miss him. And stand there and look at the clock and wonder if all of the people, ahead of you, are going to Europe or Jersey City, or where.

And stand there, and watch the clerk, and see him yawn, and tell somebody a dollar eighty, or whatever it is, and count it and put it away in the cash drawer. And go to the phone, while you're waiting, and hear him talking to the roundhouse, or wherever it is that he always talks to, while you're waiting.

And change feet, and stand there, on the other foot, and watch him, and want to kill him; and stand there, and look at the clock, and it's forty minutes since you came in, and change feet, and stand there, and watch him come over and give you your ticket, and not look at you, and take your money, and not look at you.

And when you've done that, go back to your office and think it over, and push a button, and tell somebody what you're thinking about.—*K. C. B.* in the *New York American.*

Even Railroad Theft Pricks Conscience

The Chicago, Milwaukee & St. Paul recently received $15 from an unknown person, who had been party to a theft from the railroad 24 years ago. The unsigned letter which accompanied the remittance read in part as follows:

"In February, 1893, there was four of us boys started from Cedar Rapids, Iowa, to Council Bluffs, and we bummed our way on the train, and while at either Perry or Manilla, I forgot which it was, one of the boys took a box of tobacco containing six plugs of tobacco. So I feel guilty because I did not oppose it, and afterwards helped to use the tobacco. So I want to pay you for the tobacco and for riding on your train without paying my fare. The tobacco was taken from the depot platform, so enclosed please find $15 for same."

Strong and Weak Boxes

The United States Government Forest Products Laboratory has been using a box-testing machine which shows up the weak points in box design. About 55,000,000 canned food boxes are used annually and they have been one of the chief sources of complaint by the railroads. By means of the testing machine it was discovered that increasing the number of nails in the ends increased the strength of the boxes 300 per cent. Properly nailed boxes with ¼-in. sides, tops, and bottoms withstood rougher handling than boxes with ⅜-in. sides, tops and bottoms nailed according to common practice. Several box manufacturers and canners have already accepted the results obtained and are making stronger boxes at smaller cost.

United States' Huge Foreign Trade Balance

The foreign trade balance in favor of the United States since the outbreak of the war is over five times the net debt of the nation, according to the Bureau of Foreign and Domestic Commerce. It is more than $5,500,000,000, whereas the report of the Secretary of the Treasury for September 30, 1916, showed a net debt of $1,058,289,751.82. The excess of exports over imports for the 12 months ended February 1, 1917, amounted to $3,315,849,955, approximately twice that for the previous 12 months, $1,776,028,624, and eight times that for the 12 months ended with January, 1915, $420,755,365. The total value of exports of merchandise in January, 1917, amounted to $613,441,020, nearly double that for the corresponding month of 1916, which was $330,036,410, and over three times that for January, 1914, namely $204,066,603. Corresponding figures for imports in January, 1917, amounted to $241,674,851, as against $204,834,188 in December, 1916, and $184,350,942 in January, 1916.

Testimonial to Commissioner Clements

Members and employees of the Interstate Commerce Commission held a surprise party at the hearing rooms of the commission in Washington on March 17 in honor of the 25th anniversary of Judson C. Clements' appointment as a member of the commission. Chairman Hall gave a talk on Commissioner Clements and his long and useful service, and Examiner-Attorney George N. Brown expressed the congratulations of the employees, presenting on their behalf a beautifully embossed and illuminated testimonial, mounted in a handsome frame, which was worded as follows:

"To Judson C. Clements, upon the completion of 25 years of faithful service in the public interest as Interstate Commerce Commissioner, his friends upon the commission's staff present this testimonial of their affectionate esteem and appreciation of the admirable performance of a high public duty, and express their earnest hope that he may long continue his great work in the cause of justice."

Operations of Express Companies for 1916

The Interstate Commerce Commission has issued in its preliminary abstract for 1916 the following preliminary statement of income account and profit and loss account of the principal express companies operating in the United States for the years ended June 30, 1916 and 1915:

	Grand Total		Adams Express Co.		American Express Co.		Canadian Express Co.		Globe Express Co.	
	1916 (297,138.54 miles covered)[1]	1915 (301,893.57 miles covered)[2]	1916 (45,153.38 miles covered)	1915 (44,930.22 miles covered)	1916 (74,279.85 miles covered)	1915 (74,292.79 miles covered)	1916 (12,049.93 miles covered)	1915 (10,264.13 miles covered)	1916 [4]	1915 (2,839.78 miles covered)[5]
Operating income:										
Charges for transportation	$173,709,412	$144,816,286	$42,400,411	$34,631,486	$57,619,383	$46,735,416	$3,882,748	$3,106,655	$1,362	$601,549
Express privileges—Dr.	87,971,136	73,507,563	20,886,134	17,167,041	28,788,259	23,458,861	1,990,328	1,554,427	447	303,433
Revenue from transportation	85,738,276	71,308,723	21,514,277	17,464,445	28,831,124	23,276,555	1,892,420	1,552,228	915	298,116
Revenue from operations other than transportation	5,497,237	4,178,673	583,009	508,498	3,150,023	2,388,646	121,628	107,441	11	8,111
Total operating revenues	91,235,513	75,487,396	22,097,286	17,972,943	31,981,147	25,665,201	2,014,048	1,659,669	926	306,227
Operating expenses	79,092,073	71,529,981	19,918,779	18,088,935	28,150,236	24,660,305	1,698,508	1,575,942	6,189	298,631
Net operating revenue	12,143,440	3,957,415	2,178,507	*115,992*	3,830,911	1,004,896	315,540	83,727	*5,263*	7,596
Uncollectible revenue from transportation	33,966	21,309	7,113	6,075	10,088	3,150	530	100	.....	.....
Express taxes	1,548,760	1,379,895	243,832	194,931	540,085	417,934	50,945	51,949	4,200	11,196
Operating income	10,560,714	2,556,211	1,927,562	*316,998*	3,280,738	583,812	264,065	31,678	*9,463*	*3,600*
Total other income	4,068,850	3,583,232	2,054,034	1,547,253	626,942	576,192	.....	.....	14,220	137,515
Gross income	14,629,564	6,139,443	3,981,596	1,230,255	3,907,680	1,160,004	264,065	31,678	4,757	133,915
Total deductions from gross income	1,548,376	1,305,615	950,438	974,473	238,645	188,830	264,065	31,678	.....	.....
Net income	13,081,188	4,833,828	3,031,158	255,782	3,669,035	971,174	.....	.....	4,757	133,915
Disposition of net income:										
Income applied to sinking and other reserve funds	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dividend appropriations of income	2,238,044	2,228,065	400,000	.....	.....	.....	.....	.....	.....	90,021
Income appropriations for investment in physical property	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stock discount extinguished through income	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous appropriations of income	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total appropriations	2,238,044	2,228,065	400,000	.....	.....	.....	.....	.....	.....	90,021
Balance transferred to profit and loss	10,843,144	2,605,763	2,631,158	255,782	3,669,035	971,174	.....	.....	4,757	43,894
Balance carried forward to credit of balance sheet	31,966,219	27,744,224	9,990,242	7,270,870	7,329,061	6,036,600	.....	.....	310,156	816,348

	Great Northern Express Co.		Northern Express Co.		Southern Express Co.		Wells, Fargo & Co.		Western Express Co.	
	1916 (9,837.99 miles covered)	1915 (9,582.80 miles covered)	1916 (8,274.70 miles covered)	1915 (8,233.03 miles covered)	1916 (34,764.60 miles covered)	1915 (34,665.60 miles covered)	1916 (107,529.20 miles covered)	1915 (114,692.13 miles covered)	1916 (5,248.89 miles covered)	1915 (5,232.87 miles covered)
Operating income:										
Charges for transportation	$3,384,898	$3,138,116	$3,049,797	$2,778,592	$16,504,462	$14,085,100	$45,434,665	$38,555,664	$1,431,686	$1,183,708
Express privileges—Dr.	2,062,411	1,903,533	1,652,671	1,515,586	8,488,216	7,278,117	23,414,248	19,724,414	688,422	602,151
Revenue from transportation	1,322,487	1,234,583	1,397,126	1,263,006	8,016,246	6,806,983	22,020,417	18,831,250	743,264	581,557
Revenue from operations other than transportation	58,889	52,689	47,366	40,251	357,401	300,882	1,134,902	734,633	44,008	37,522
Total operating revenues	1,381,376	1,287,272	1,444,492	1,303,257	8,373,647	7,107,865	23,155,319	19,565,883	787,272	619,079
Operating expenses	1,080,023	1,058,576	1,081,061	1,060,618	6,637,119	6,302,801	19,847,688	17,860,840	672,470	623,333
Net operating revenue	301,353	228,696	363,431	242,639	1,736,528	805,064	3,307,631	1,705,043	114,802	*4,254*
Uncollectible revenue from transportation	213	124	750	205	1,153	562	14,043	10,878	76	115
Express taxes	45,981	45,155	62,930	60,642	173,137	172,958	413,720	413,293	13,930	11,837
Operating income	255,159	183,417	299,751	181,792	1,562,238	631,444	2,879,868	1,280,872	100,796	*16,206*
Total other income	2,752	2,556	49,612	50,222	126,989	147,692	1,190,595	1,119,182	3,706	2,620
Gross income	257,911	185,973	349,363	232,014	1,689,227	779,136	4,070,463	2,400,054	104,502	*13,586*
Total deductions from gross income	1,230	8,876	13,846	9,596	29,809	30,261	49,689	61,377	654	524
Net income	256,681	177,097	335,517	222,418	1,659,418	748,875	4,020,774	2,338,677	103,848	*14,110*
Disposition of net income:										
Income applied to sinking and other reserve funds	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dividend appropriations of income	.....	100,000	.....	200,000	400,000	400,000	1,438,044	1,438,044	.....	.....
Income appropriations for investment in physical property	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Stock discount extinguished through income	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Miscellaneous appropriations of income	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total appropriations	.....	100,000	.....	200,000	400,000	400,000	1,438,044	1,438,044	.....	.....
Balance transferred to profit and loss	256,681	77,097	335,517	22,418	1,259,418	348,875	2,582,730	900,633	103,848	*14,110*
Balance carried forward to credit of balance sheet	658,057	397,345	500,426	164,403	2,887,365	6,069,442	10,195,884	7,478,401	95,028	10,815

[1] Includes 8,698.99 miles of electric lines, 34,007.14 miles of steamboat lines, and 682.37 miles of stage lines.
[2] Includes 8,266.88 miles of electric lines, 40,703.64 miles of steamboat lines, and 696.18 miles of stage lines.
[3] Represents balance turned over to Grand Trunk Ry. Co. of Canada.
[4] Discontinued active operations on all lines April 30, 1915. See note 2.
[5] Report covers operations for ten months ended April 30, 1915; mileage not included in "Grand total."

RAILWAY EARNINGS AND EXPENSES FOR DECEMBER

The Interstate Commerce Commission has issued the following compilation, subject to revision, from reports of revenues and expenses of steam roads in the United States for the month of December, 1916. This summary covers only roads having operating revenues above $1,000,000 for the year ended June 30, 1916:

SUMMARY OF MONTHLY REPORTS OF LARGE ROADS

Item.	United States				Eastern District				Southern District				Western District			
	Amount		Per mile of road operated		Amount		Per mile of road operated		Amount		Per mile of road operated		Amount		Per mile of road operated	
	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915
Average number miles operated	230,986.00	229,903.75	...	...	59,288.73	59,081.72	...	...	42,677.53	42,450.41	...	...	129,019.74	128,371.62	...	...
REVENUES:	Dollars	Dollars	Dolls.	Dolls.	Dollars	Dollars	Dolls.	Dolls.	Dollars	Dollars	Dolls.	Dolls.	Dollars	Dollars	Dolls.	Dolls.
Freight	214,550,042	206,380,030	929	898	91,131,886	92,197,381	1,537	1,561	33,932,940	31,375,667	795	769	89,485,216	82,806,982	694	645
Passenger	65,414,781	55,570,292	283	242	27,858,712	23,592,409	470	399	10,245,178	8,414,481	240	198	27,310,891	23,563,402	211	184
Mail	5,669,114	5,044,260	25	22	2,260,461	1,852,320	38	31	860,354	636,101	20	15	2,548,299	2,555,839	20	20
Express	9,086,642	7,316,068	39	32	3,911,123	3,285,601	66	56	1,457,408	1,209,334	34	29	3,718,111	2,818,133	29	22
All other transportation	8,664,855	8,106,115	37	35	4,805,427	4,539,298	81	77	661,835	585,762	16	14	3,197,593	2,981,055	24	23
Incidental	7,099,586	5,518,454	31	24	3,729,395	2,986,384	63	50	909,567	683,170	22	16	2,460,624	1,848,900	19	14
Joint facility—Cr	385,296	297,278	2	1	166,432	136,148	3	2	117,169	72,719	3	2	101,695	86,411	1	1
Joint facility—Dr	134,423	130,781	1	1	76,385	79,988	1	1	22,548	24,194	1	1	35,490	26,599	...	...
Railway operating revenues	310,735,893	288,098,716	1,345	1,253	133,787,051	128,509,553	2,257	2,175	48,161,903	42,953,040	1,129	1,012	128,786,939	116,636,123	998	909
EXPENSES:																
Maintenance of way and structures	29,670,835	29,529,598	128	128	12,044,859	12,597,611	203	213	4,949,199	4,722,394	116	111	12,676,777	12,209,593	98	95
Maintenance of equipment	51,011,182	46,389,190	221	202	23,257,731	22,628,217	392	383	7,662,065	7,511,877	179	177	20,091,386	16,249,096	156	127
Traffic	5,681,935	4,933,151	25	21	2,158,025	1,845,175	37	31	1,064,590	970,624	25	23	2,459,320	2,117,352	19	16
Transportation	113,048,439	95,049,112	489	414	54,192,208	45,689,181	914	774	14,671,573	12,819,429	344	302	44,184,658	36,540,502	342	285
Miscellaneous operations	2,505,183	2,075,641	11	9	1,202,072	998,321	20	17	243,639	187,682	6	4	1,059,472	889,638	8	7
General	8,337,175	6,980,243	36	30	3,687,147	3,059,484	62	52	1,164,284	1,083,003	27	26	3,485,744	2,837,756	27	22
Transportation for investment—Cr	1,233,733	446,861	5	2	100,009	56,661	1	1	150,943	97,110	3	2	982,781	293,088	7	2
Railway operating expenses	209,021,016	184,510,067	905	802	96,442,035	86,761,328	1,627	1,469	29,604,407	27,197,890	694	641	82,974,576	70,550,849	643	550
Net revenue from railway operations	101,714,877	103,588,649	440	451	37,345,018	41,748,225	630	706	18,557,496	15,755,150	435	371	45,812,363	46,025,274	355	359
Railway tax accruals	14,826,762	12,307,637	64	54	5,764,378	4,776,484	97	81	2,063,612	1,749,316	49	41	6,998,772	5,781,837	54	45
Uncollectible railway revenues	118,305	62,171	1	...	47,191	26,354	1	...	14,287	10,256	...	...	56,827	25,561	1	...
Railway operating income	86,769,810	91,218,841	375	397	31,533,449	36,945,387	532	625	16,479,507	13,995,578	386	330	38,756,764	40,277,876	300	314
FOR THE SIX MONTHS ENDED WITH DECEMBER																
	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915
Average number miles operated	230,746.42	229,570.35	...	...	59,262.26	59,104.30	...	...	42,646.04	42,185.96	...	...	128,838.12	128,280.09	...	...
REVENUES:	Dollars	Dollars	Dolls.	Dolls.	Dollars	Dollars	Dolls.	Dolls.	Dollars	Dollars	Dolls.	Dolls.	Dollars	Dollars	Dolls.	Dolls.
Freight	1,356,039,797	1,196,392,624	5,877	5,211	589,459,552	537,966,087	9,946	9,102	197,364,220	174,674,161	4,628	4,140	569,216,025	483,752,376	4,418	3,771
Passenger	392,161,716	359,355,568	1,699	1,565	175,378,075	155,575,560	2,959	2,632	52,954,609	45,438,552	1,242	1,077	163,829,032	158,341,456	1,271	1,234
Mail	31,075,344	29,983,064	134	130	11,554,712	11,078,045	195	187	4,559,785	3,818,894	107	90	14,960,847	15,085,125	116	117
Express	48,161,521	38,933,257	209	170	22,706,172	17,903,049	383	303	6,524,673	5,382,850	153	128	18,930,676	15,647,358	147	122
All other transportation	53,935,488	49,377,649	234	215	30,565,023	27,901,688	516	472	4,011,051	3,532,162	94	84	19,359,414	17,943,799	150	140
Incidental	43,596,037	35,344,261	189	154	24,129,969	18,300,592	407	310	4,863,042	3,737,259	114	89	14,603,026	13,306,410	113	104
Joint facility—Cr	2,002,921	1,773,737	9	8	954,792	838,304	16	14	444,578	413,586	10	10	603,551	521,847	5	4
Joint facility—Dr	763,623	704,016	3	3	450,678	421,382	7	7	132,794	132,021	3	3	180,151	150,613	1	1
Railway operating revenues	1,926,209,201	1,710,456,144	8,348	7,450	854,297,617	769,142,943	14,415	13,013	270,589,164	236,865,443	6,345	5,615	801,322,420	704,447,758	6,219	5,491
EXPENSES:																
Maintenance of way and structures	220,173,081	202,836,222	954	884	91,842,821	85,296,637	1,550	1,443	34,516,414	30,735,277	809	729	93,813,846	86,804,308	728	676
Maintenance of equipment	307,183,508	269,256,414	1,331	1,173	146,716,848	127,278,299	2,475	2,153	46,994,945	43,849,571	1,102	1,040	113,471,715	98,128,544	881	765
Traffic	32,163,539	29,951,823	139	130	12,501,042	11,188,223	211	189	5,952,923	5,406,796	140	128	13,709,574	13,356,804	106	104
Transportation	614,498,318	530,030,772	2,663	2,309	296,946,985	249,637,512	5,011	4,224	79,293,448	71,975,228	1,859	1,706	238,257,885	208,418,032	1,849	1,625
Miscellaneous operations	14,454,565	13,041,558	63	57	7,028,611	5,711,637	118	97	1,333,341	1,093,235	31	26	6,092,613	6,236,686	47	49
General	43,978,525	38,667,901	191	168	19,412,575	16,770,920	328	284	6,719,001	6,128,519	158	145	17,846,949	15,768,462	139	123
Transportation for investment—Cr	1,908,963	3,344,657	21	15	580,638	356,275	10	6	699,159	551,934	16	13	3,629,166	2,436,448	28	19
Railway operating expenses	1,227,542,573	1,080,440,033	5,320	4,706	573,868,244	405,526,953	9,683	8,384	174,110,913	158,636,692	4,083	3,761	479,563,416	426,276,388	3,722	3,323
Net revenue from railway operations	698,666,628	630,016,111	3,028	2,744	280,429,373	273,615,990	4,732	4,629	96,478,251	78,228,751	2,262	1,854	321,759,004	278,171,370	2,497	2,168
Railway tax accruals	83,100,652	71,730,721	360	312	33,100,236	28,269,222	558	478	11,670,867	9,869,477	274	234	38,329,549	33,592,022	298	262
Uncollectible railway revenues	477,095	389,822	2	2	242,698	148,990	4	3	53,591	79,865	1	2	180,806	160,967	1	1
Railway operating income	615,088,881	557,895,568	2,666	2,430	247,086,439	245,197,778	4,170	4,148	84,753,793	68,279,409	1,987	1,618	283,248,649	244,418,381	2,198	1,905

Offers Ground for Cultivation

The Nashville, Chattanooga & St. Louis has offered the track repair men the use of spare tracts on the right-of-way for gardens.

Railway Earnings and Expenses for the Calendar Year

The Bureau of Railway Economics has issued its monthly bulletin of railway revenues and expenses for the month of December and the calendar year 1916.

The net operating income of railways of the United States for December, 1916, was less than that for December, 1915, by $22 per mile, or 5.3 per cent.

Total operating revenues, $310,735,893, exceeded those for December, 1915, by $22,637,177. Operating expenses, $209,021,016, were greater by $24,510,949. Net operating revenue, $101,714,877, fell off by $1,873,772. Taxes, $14,826,762, increased by $2,519,125. Net operating income was $86,769,810, a decrease of $4,449,031.

If spread over the mileage represented, operating revenues averaged $1,345 per mile, an increase of 7.4 per cent; operating expenses per mile, $905, were greater by 12.8 per cent; net operating revenue per mile, $440, decreased 2.3 per cent, and net operating income per mile, $375, showed a decrease of 5.3 per cent. Taxes per mile rose 19.9 per cent.

This summary covers 230,986 miles of operated line, or about 90 per cent of the steam railway mileage of the United States.

The whole calendar year, 1916, is covered by the accompanying table. Total operating revenues for 1916 amounted to $3,622,057,141, an average of $15,701 per mile of line; operating expenses amounted to $2,373,439,156, or $10,289 per mile; net operating revenue amounted to $1,248,617,985, or $5,412 per mile. Compared with the preceding calendar year, the year 1916 shows an increase in aggregate operating revenues of $538,644,918, or 16.8 per cent per mile; an increase in aggregate operating expenses of $307,436,774, or 14.2 per cent per mile; an increase in net operating revenue of $231,208,144, or 22.0 per cent per mile. Taxes were higher by $19,160,814, or 13.1 per cent per mile, while operating income increased $211,946,351, or 23.4 per cent per mile.

Operating income per mile was greater than for 1915 in each of the three districts, as follows: It increased 19.9 per cent in the eastern district, increased 37.0 per cent in the southern district, and increased 23.1 per cent in the western district.

While the revenues and expenses per mile were greater for each month than in 1915, the percentage by which net revenue per mile was above the level of 1915 fell almost continuously throughout the year. In November net revenue per mile was slightly less than in 1915, while in December it showed a greater decrease. A similar tendency may be traced in the southern, eastern and western districts, although with some variations as between the districts.

Confining this monthly survey to operating income per mile, which is net revenue less taxes, the following table brings out the same tendency:

PER CENT OF INCREASE (OR DECREASE) OF OPERATING INCOME PER MILE OVER CORRESPONDING MONTH OF 1915

1916	United States	East	South	West
January	64.5	130.3	63.2	18.4
February	67.8	115.8	83.4	29.2
March	48.4	56.0	49.8	41.4
April	42.3	34.6	39.8	54.4
May	52.6	49.4	56.7	55.7
June	25.9	18.6	55.3	26.9
July	24.7	21.0	18.3	31.1
August	27.1	16.6	36.4	36.8
September	10.0	0.6	14.6	18.7
October	8.7	d 4.4	27.0	16.5
November	d 1.8	d 13.7	25.2	1.7
December	d 5.3	d 14.9	17.1	d 4.3

National Scale Men's Association

The National Scale Men's Association held its second annual meeting at the Ft. Dearborn Hotel, Chicago, March 19, 20 and 21. Among the subjects discussed were many of interest to railroad men, as the "Efficiency of Railroad Track Scales," "Stenciled Weight vs. Actual Weight," "Grain Scales and Grain Weighing," "Automatic Scales," "Depot Platform Scales," "Track Scale Automatic Weight Recorders," "Relieving Gears vs. Dead Rails," "Construction of Scale Pits," and "Ventilation, Drainage and Heating of Scale Pits and Care of Track Scales."

SUMMARY FOR THE CALENDAR YEAR 1916 OF REVENUES AND EXPENSES OF STEAM ROADS

Compiled from monthly returns of the railways to the Interstate Commerce Commission and covering roads of Class I, i.e., roads with annual operating revenues above $1,000,000.

Account	United States				Eastern District				Southern District				Western District			
	Amount, 1916	Per mile of line 1916	Per mile of line 1915	Increase over 1915 Per cent	Amount, 1916	Per mile of line 1916	Per mile of line 1915	Increase over 1915 Per cent	Amount, 1916	Per mile of line 1916	Per mile of line 1915	Increase over 1915 Per cent	Amount, 1916	Per mile of line 1916	Per mile of line 1915	Increase over 1915 Per cent
Total operating revenues	$3,622,057,141	$15,701	$13,445	16.8	$1,637,712,905	$27,675	$23,514	17.7	$524,865,544	$12,267	$10,495	16.9	$1,459,478,692	$11,338	$9,776	16.0
Freight	2,573,832,109	11,158	9,368	19.1	1,149,887,164	19,431	16,413	18.4	386,752,920	9,039	7,706	17.3	1,037,192,025	8,058	6,667	20.9
Passenger	708,020,983	3,069	2,818	8.9	316,759,583	5,353	4,747	12.8	98,562,656	2,304	2,009	14.6	292,698,744	2,274	2,196	3.5
Mail	61,221,561	265	255	4.1	22,805,099	386	363	6.1	8,398,121	196	179	9.7	30,018,341	233	230	1.4
Express	90,293,551	391	318	23.2	42,625,020	720	560	28.7	13,085,337	306	247	23.9	34,583,194	268	230	17.2
All other	188,688,937	818	686	19.2	105,636,039	1,785	1,431	24.8	18,066,510	422	354	19.4	64,986,388	505	453	11.4
Total operating expenses	2,373,439,156	10,289	9,009	14.2	1,113,013,365	18,808	16,060	17.1	341,025,876	7,970	7,288	9.4	919,399,915	7,142	6,325	12.9
Maintenance of way and structures	424,032,705	1,838	1,641	12.0	176,621,625	2,985	2,687	11.1	64,352,020	1,504	1,401	7.3	183,059,060	1,422	1,237	15.0
Maintenance of equipment	597,915,428	2,592	2,230	16.2	286,923,974	4,849	4,125	17.5	94,038,939	2,198	1,941	13.2	216,952,515	1,685	1,452	16.1
Traffic	62,887,015	273	261	4.6	24,044,784	406	381	6.6	11,752,675	274	254	8.4	27,089,556	210	207	1.5
Transportation	1,184,620,509	5,135	4,467	15.0	576,022,074	9,734	8,137	19.6	156,281,052	3,653	3,384	7.9	452,317,383	3,514	3,132	12.2
General	84,911,697	368	334	10.3	37,359,839	631	561	12.6	13,238,879	309	285	8.5	34,312,979	267	245	8.9
All other	19,071,802	83	76	8.1	12,041,069	203	169	20.4	1,362,311	32	23	38.6	5,668,422	44	52	d 14.4
Net operating revenue	1,248,617,985	5,412	4,436	22.0	524,699,540	8,867	7,454	19.0	183,839,668	4,297	3,207	34.0	540,078,777	4,196	3,451	21.6
Taxes	158,587,793	687	608	13.1	63,680,530	1,076	956	12.6	22,486,291	526	454	15.8	72,420,972	563	498	12.9
Uncollectible revenues	893,009	4	3	....	354,001	6	4	....	161,673	4	4	....	377,335	3	3	....
Operating income	1,089,137,183	4,721	3,825	23.4	460,665,009	7,785	6,494	19.9	161,191,704	3,767	2,749	37.0	467,280,470	3,630	2,950	23.1
Operating ratio—per cent—																
1916		65.5				68.0				65.0				63.0		
1915		67.0				68.3				69.4				64.7		
Average mileage represented—																
1916		230,68[illegible]				59,178				42,786				128,719		
1915		229,341				59,030				42,403				127,908		

d Decrease.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of those associations which will meet during the next three months. The full list of meetings and conventions is published only in the first issue of the Railway Age Gazette for each month.

AIR BRAKE ASSOCIATION.—F. M. Nellis, Room 3014, 165 Broadway, New York City. Next annual convention, May 1-4, 1917, Hotel Chisca, Memphis, Tenn.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Next meeting, June 13-20, Atlantic City, N. J.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—Chas. Warren Hunt, 220 W. 57th St., New York. Regular meetings, 1st and 3d Wednesday in month, except July and August, 220 W. 57th St., New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., New York. Next convention, May 21-24, Cincinnati, Ohio.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—E. R. Woodson, Rooms 1116-8 Woodward Bldg., Washington, D. C. Annual meeting, May 30, 1917, Hotel Jefferson, Richmond, Va.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—Willis H. Failing, Terminal Station, Central of New Jersey, Jersey City, N. J. Next meeting, May, 1917, Cincinnati, Ohio.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk, P. O. Box 7, St. Lambert (near Montreal), Que. Regular meetings, 2d Tuesday in month, except June, July and August, Windsor Hotel, Montreal, Que.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 176 Mansfield St., Montreal, Que. Regular meetings, 1st Thursday in October, November, December, February, March and April. Annual meeting, January, Montreal.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 Lawlor Ave., Chicago. Regular meetings, 2d Monday in month, except June, July and August, Hotel La Salle, Chicago.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York. Regular meetings, 2d Friday in January, May, September and November. Annual dinner, 2d Thursday in March, Hotel Statler, Buffalo, N. Y.

CINCINNATI RAILWAY CLUB.—H. Boutet, Chief Interchange Inspector, Cin'ti Rys., 101 Carew Bldg., Cincinnati. Regular meetings, 2d Tuesday, February, May, September and November, Hotel Sinton, Cincinnati.

ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—Elmer K. Hiles, 2511 Oliver Bldg., Pittsburgh, Pa. Regular meetings, 1st and 3d Tuesday, Pittsburgh, Pa.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Traffic Manager, R. F. & P., Richmond, Va. Annual convention, June 19, Chicago, Ill.

GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—A. M. Hunter, 321 Grand Central Station, Chicago. Regular meetings, Wednesday, preceding 3d Thursday in month, Room 1856, Transportation Bldg., Chicago.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—J. G. Crawford, C. B. & Q. R. R., 702 E. 51st St., Chicago. Next meeting, May 14-17, Hotel Sherman, Chicago.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Annual convention, May 22-25, Hotel Jefferson, Richmond, Va.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Next meeting, June 13-20, Atlantic City, N. J.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting, 2d Tuesday in month, except June, July, August and September, Boston.

NEW YORK RAILROAD CLUB.—Harry D. Vought, 95 Liberty St., New York. Regular meeting, 3d Friday in month, except June, July and August, 29 W. 39th St., New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—Geo. A. J. Hochgiebe, 623 Brisbane Bldg., Buffalo, N. Y. Meetings, 3d Wednesday in month, New York Telephone Bldg., Buffalo, N. Y.

PEORIA ASSOCIATION OF RAILROAD OFFICERS.—F. C. Stewart, 410 Masonic Temple Bldg., Peoria, Ill. Regular meetings, 3d Thursday in month, Jefferson Hotel, Peoria.

RAILROAD CLUB OF KANSAS CITY.—Claude Manlove, 1008 Walnut St., Kansas City, Mo. Regular meetings, 3d Saturday in month, Kansas City.

RAILWAY CLUB OF PITTSBURGH.—J. B. Anderson, Room 207, P. R. R. Sta., Pittsburgh, Pa. Regular meetings, 4th Friday in month, except June, July and August. Pittsburgh Commercial Club Rooms, Colonial-Annex Hotel, Pittsburgh.

RAILWAY DEVELOPMENT ASSOCIATION.—D. C. Welty, Commissioner of Agriculture, St. L., Iron Mt. & So., 1047 Railway Exchange Bldg., St. Louis. Annual meeting, May 9-11, Louisville, Ky.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, N. Y. C. R. R., Box C, Collinwood, Ohio. Annual convention, May 21-23, Chicago.

RICHMOND RAILROAD CLUB.—F. O. Robinson, C. & O., Richmond, Va. Regular meetings, 2d Monday in month, except June, July and August.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, 2d Friday in month, except June, July and August, St. Louis.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grand Bldg., Atlanta, Ga. Regular meetings, 3d Thursday, January, March, May, July, September, November, 10 a. m., Piedmont Hotel, Atlanta.

TOLEDO TRANSPORTATION CLUB.—Harry S. Fox, Toledo, Ohio. Regular meetings, 1st Saturday in month, Boody House, Toledo.

TRAFFIC CLUB OF CHICAGO.—W. H. Wharton, La Salle Hotel, Chicago.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 291 Broadway, New York. Regular meetings, last Tuesday in month, except June, July and August, Waldorf-Astoria Hotel, New York.

TRAFFIC CLUB OF PITTSBURGH.—D. L. Wells, Gen'l Ag't, Erie R. R., 1924 Oliver Bldg., Pittsburgh, Pa. Meetings bi-monthly, Pittsburgh.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7122 Stewart Ave., Chicago. Next meeting, June 19, Fresno, Cal.

UTAH SOCIETY OF ENGINEERS.—Frank W. Moore, 1111 Newhouse Bldg., Salt Lake City, Utah. Regular meetings, 3d Friday in month, except July and August, Salt Lake City.

WESTERN CANADA RAILWAY CLUB.—L. Kon, Immigration Agent, Grand Trunk Pacific, Winnipeg, Man. Regular meetings, 2d Monday, except June, July and August, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, 1112 Karpen Bldg., Chicago. Regular meetings, 3d Monday in month, except June, July and August, Hotel Sherman, Chicago.

WESTERN SOCIETY OF ENGINEERS.—E. N. Layfield, 1735 Monadnock Block, Chicago. Regular meetings, 1st Monday in month, except January, July and August, Chicago. Extra meetings, except in July and August, generally on other Monday evenings. Annual meeting, 1st Wednesday after 1st Thursday in January, Chicago.

Traffic News

The Transportation Club of San Francisco has chosen A. H. Dougall, Jr., president for the ensuing year; secretary, Frederick Birdsall; treasurer, J. W. Adams.

The Traffic Club of the Flint (Mich.) board of commerce has appointed Ned Vermilya secretary in place of N. D. Taylor. The meetings of this club are held on the second and fourth Tuesdays of every month.

The movement of automobiles from the factories in Detroit to distant cities, by their own power, because of the congestion of traffic on the railroads, has assumed large proportions. The gasoline vehicles are sent as far as Louisville, Ky. It is said that the number of automobiles thus sent out from Detroit has reached 500 in a single day.

The American Railway Association reports a reduction of 41 per cent—from 171,005 cars to 99,774 cars—in the last three weeks in the number of freight cars, loaded and empty, held at various points because they could not be moved, for one reason or another. The accumulations of cars because of embargoes, congestion and weather conditions, for the last four weeks, were as follows: February 17, 171,005; February 24, 143,550; March 3, 123,063; March 10, 99,774.

The Lehigh Valley is going to run a "Potato Special," the railroad company's agricultural car having been refitted for demonstration purposes. The latest methods of treating seed, the benefits of spraying, the proper ingredients of the liquid to be used, and all the other things one needs to know about potato growing will be shown on the car. The road will work in close co-operation with the county farm bureaus of Cayuga, Tompkins, Monroe and Niagara Counties, New York, and Wyoming and Sullivan Counties, Pennsylvania, and with Cornell University.

The hearing on proposed class rates in Central Freight Association is still in session at Chicago before W. J. Disque, examiner of the Interstate Commerce Commission. Additional testimony of representatives of shippers was taken during the latter part of last week and the fore part of this week. The general complaint is that the proposed scale changes the rate adjustment between competing cities. H. C. Barlow, of the Chicago Association of Commerce, indorsed the position of the railroads that they are in need of additional revenue, but opposed the scale as not well devised. In the early part of this week rates to cross lake points were discussed. Shippers from Manitowoc, Wis.; Marinette, Sheboygan and Kewaunee protested that the new rates would establish a different relation between their cities and Milwaukee and Chicago, and would prove more disadvantageous to them in competing with those cities than the present scale.

Reduction in Coal Rates to Philadelphia

The railroads carrying anthracite to Philadelphia, Pa., from the Lehigh, Schuylkill and Wyoming regions have decided to reduce the freight rates on prepared sizes of coal on April 1, to $1.45; on pea coal $1.25 and on smaller sizes $1.20. The reduction from former rates on prepared sizes is 25 cents a ton; on pea coal 15 cents a ton, and on smaller sizes 5 cents a ton. A complaint from Philadelphia has been before the Public Service Commission of the State for several years; and on January 5, 1915, the Public Service Commission ordered reductions considerably larger than those here specified—40 cents a ton on prepared sizes. This order was contested by the railroads in the courts, and the present action of the roads, based on a compromise agreement with the Philadelphia interests, is the outcome of the litigation and discussion which have taken place during the past two years. The Public Service Commission has issued a new order approving the compromise.

The foregoing rates are for shipments from the Schuylkill region. From the Wyoming and Lehigh regions the rates are not exactly the same, but the reduction in each case is equal to that from the Schuylkill region.

Commission and Court News

INTERSTATE COMMERCE COMMISSION

The commission has suspended until July 18 tariffs providing for increased commodity rates on cement, carloads, from points in Kansas and other points of origin to destinations on the Chicago, Burlington & Quincy in South Dakota, Wyoming and Montana. The proceeding has been assigned for hearing on March 26 at Washington before Commissioner Daniels in connection with the general cement investigation.

The commission in conference on March 12, 1917, voted to amend the fourth paragraph of Conference Ruling 354 to read as follows: "That it is not lawful for a carrier subject to this act to issue through bills of lading under an arrangement with a water or other carrier for a continuous carriage until rates applicable to such carriage or shipment, under schedule lawfully filed with this commission by such water or other carrier, shall have become effective."

The Interstate Commerce Commission has postponed from April 1 to July 1 the effective date of its order denying the application under the Panama Canal act of the Norfolk & Western Railway to continue the operation of the Old Dominion Steamship Company and the Virginia Navigation Company and the Old Dominion Steamship Company is authorized to change on one day's notice its rates on cotton and unmanufactured tobacco moving on export bills of lading to foreign countries provided the rates are not increased.

Proposed Advances in Coal Rates

The Interstate Commerce Commission has called an informal hearing to be held at Washington on March 22 before Commissioner Clements, sitting with the board of suspension, on applications to suspend tariffs of the Chesapeake & Ohio, Norfolk & Western and Virginian, filed to become effective April 1, naming increased tidewater rates on bituminous coal from Virginia and West Virginia fields to Hampton Roads, and tariffs of those carriers naming increased rates on coke to interior Virginia destinations. Consideration was to be given at the same time to the tariffs of the Pennsylvania System, Baltimore & Ohio, Norfolk & Western, Chesapeake & Ohio, Western Maryland, Virginian and New York Central Lines, filed to become effective April 16 or at later dates, naming increased tidewater rates on bituminous coal from coal fields of Pennsylvania, Maryland, Virginia, West Virginia, Ohio and Kentucky to New York, Philadelphia and Baltimore; and on lake cargo coal; also proposed increased rates on bituminous coal from Pennsylvania and Ohio fields to Buffalo and Buffalo rate group points; subject to further showing by any protestants. The proposed increases per ton are 10 cents to Hampton Roads; 5 cents to Upper Tidewater; from 5 cents to 15 cents on lake cargo coal; 15 cents to Buffalo rate points, and from 10 to 65 cents on coke to Virginia stations.

COURT NEWS

Law Governing Bills of Lading

The Minnesota Supreme Court holds that the state statute of 1909, making a bill of lading, acquired in good faith and for value, conclusive that the carrier issuing it received the goods therein specified, has no application and no effect where the liability of the common carrier arises out of the issuance of an interstate bill of lading.—Lowitz v. C. St. P. M. & O. (Minn.), 161 N. W., 411.

No Authority in Railroad's Agents to Admit Negligence

In an action to recover damages to the plaintiff's automobile by collision with one of the defendant's freight cars in its yards, alleged to have been the result of the defendant's negligence, the Minnesota Supreme Court holds that evidence that the defendant's local freight agent and its claim agent stated some time after the accident that there would be no trouble about a settlement, offered as an admission of negligence, was properly refused. Neither of them was present at the accident; it was not part of the res gestae. Conceding that so general a statement could be construed as an admission of negligence, there was no authority in either agent to bind the company by such an admission.—Elliott Jobbing Co. v. C. St. P. M. & O. (Minn.), 161 N. W., 390.

Right to Construct Embankment Against Floods

The Supreme Court of Appeals of Virginia holds that a railroad which, to protect its line, builds a high embankment several feet from the shore line (on James River) at low water mark, and narrows the channel of the river, is not liable therefor to a riparian owner whose land is damaged by the flood of an unusual and extraordinary freshet. A railroad is within its rights in changing the location of its track from one part of its right of way to another to escape the danger incident to a very sharp curve, and in constructing an embankment sufficiently high to protect its roadbed and other property from injury by accidental and extraordinary floods.—C. & O. v. Meriwether (Va.), 91 S. E., 92.

"Interstate Passenger"

A. bought a ticket over the defendant's railroad from Oklahoma City, Okla., to Colbert, Okla., intending to proceed from the latter place to Achille, also within Oklahoma. On reaching Atka, Okla., he decided to go to Denison, Tex., and tendered the defendant the unused portion of his ticket entitling him to passage as an intrastate passenger from Atoka to Colbert and cash fare at the interstate rate from Colbert to Denison. This was refused, and the defendant demanded of him in addition to his ticket one cent a mile from Atoka to Colbert, which, with the ticket and the cash tendered by the plaintiff, would equal the published rate for one continuous passage from Atoka to Denison. The plaintiff refused to pay this amount, and was put off the train at Colbert. He sued for damages for the eviction. The Oklahoma Supreme Court held that the plaintiff was an "interstate passenger" from Atoka to Denison, and was required to pay the published rate between these points. On his refusal the defendant was entitled to eject him. The principle is the same as has frequently been applied to shipments of goods.—M. K. & T. (Okla.), 162 Pac., 814.

Fires as Proximate Cause of Injury

Fire escaped from a locomotive, ignited weeds and brush on the right of way, and was communicated to the adjacent pasture, where cattle were feeding. The cattle, because of the smoke and roar of the fire, stampeded, and subsequently, for a period of 80 days, gained only about a pound a day instead of 2½ or 3 pounds a day. They did not come in contact with the flames and were not burned. In an action against the railroad for damages the Circuit Court of Appeals, Eighth Circuit, held that the wrong could not, as a matter of law, be held to be the proximate cause of the injury to the cattle. Such an injury is not one in the common experience of mankind known to be likely to result from a fire. A wrongdoer is not liable for an injury which could not be reasonably foreseen or anticipated as the probable result of the wrong. If the wrong and resulting damage are not known by common experience to be naturally and usually in sequence, and the damage does not, according to the ordinary course of events, follow from the wrong, then the damage is not sufficiently shown to be the result of the wrong to support an action.—C. B. & Q., 238 Fed., 14.

Government Loses Central Pacific Suit

A decision was filed at Salt Lake City, Utah, on March 10, by Circuit Judges W. H. Sanborn of St. Paul, Minn., William C. Hook of Leavenworth, Kan., and John E. Carland of Washington, D. C., sitting as the United States District Court of Utah, which denied the petition of the government to separate the Central Pacific from the Southern Pacific. The opinion says that it is doubtful whether the Sherman anti-trust law can reach proprietary relations formed prior to the passage of the law. The consolidation of the Southern Pacific and the Central Pacific actually began in 1870. If the anti-trust act is construed to reach proprietary relations as distinguished from those of a mere

continuous operating character formed long prior to its passage, whereby divergent and tangential lines of road to widely separated gateways or points in the current of traffic movement are held in a single ownership or control, its enforcement would have such a destructive effect upon established railroad systems of the country that their inclusion within the intent of Congress may well be doubted. The court also pointed out that the operation of the Central Pacific as a part of the Southern Pacific system has not been shown to have any injurious effect on shippers. A minority opinion was delivered by Judge Carland.

Invitation to Cross—Contributory Negligence

A railroad crossing is a dangerous place, and the man who approaches it is careless if he does not do so as if it were dangerous. One who is invited to cross by the conduct of the railroad company, or of its employees or agents, or even directly by such employees or agents, is not justified in acting as though it were not dangerous, and will not be permitted to throw off from himself the responsibility for the outcome. He is still bound to act with common prudence in view of the dangers of the place as well as of the invitation. An automobile driver, about 150 feet from a crossing, where his view of the tracks was obstructed by buildings, was going slowly and had his car under control. At that point a flagman at the crossing signaled him to come ahead. He speeded up his car, going down grade, from less than 10 miles an hour to about 20, until, when 50 feet from the crossing, he could plainly see 260 feet of the tracks. A companion with him saw a train approaching in time to jump off and escape, but the driver continued and was killed, the train striking the automobile when partly over the crossing. In an action for his death the Connecticut Supreme Court of Errors held that the railroad was not liable. It was certain that a reasonably careful approach at a moderate speed, and with the car under proper control, was all that was necessary for the deceased's safety. The situation was explainable only on one of four assumptions: (1) That he did not look; (2) that he was going so fast and had so little control of his car, that he could not stop after, by looking, he was able to see the tracks; (3) that he both failed to look and was going at too great a speed; or (4) that he was going at such a speed when the train was seen that he chose to venture to cross rather than to stop when he might.—Hayes v. N. Y. N. H. & H. (Conn.), 99 Atl., 694.

Free Lease of Factory Site Held Void as Discriminatory

An interstate carrier leased to a manufacturer of wagons a site for his factory, which was worth more than $5,000, and had a rental value of $300, for a term of 20 years from April, 1903, with an option for renewal. The lease reserved no rent, but provided that the tenant should save the lessor harmless from liability caused or increased by the tenant's use of the premises, and should furnish, free of expense to the lessor, a lease for the right of way for a spur track from the lessor's line to the factory, which the lessor could use for its own purposes when it was not required for the use of the tenant. It further provided that the tenant would not assign the lease except to another manufacturer which shipped approximately the same amount of freight, and so far as it could would have all freight, in and out, carried over the lessee's lines. The railroad subsequently sued in equity to have the lease canceled, or that the tenant should pay a reasonable rental, alleging that the lease was in violation of the act to regulate commerce, as it unjustly discriminated against other shippers along its right of way. The lease was originally granted in pursuance of a policy of the railroad of encouraging the location of industries along its lines to increase its traffic; and its real intention was to give the defendant the use of the premises rent free. The Circuit Court of Appeals, Fifth Circuit, has reversed a decree sustaining a motion to dismiss the bill, holding that the consideration for the lease was clearly the business which the carrier expected to derive from the tenant, not the other considerations the tenant undertook to perform, which were mere incidents of the tenancy; that the lease was illegal under the statutes mentioned; and that the railroad, as a party to a transaction prohibited and penalized by law, could not estop itself from setting up its invalidity.—Central of Georgia v. Blount, 238 Fed., 292.

Railway Officers

Executive, Financial, Legal and Accounting

E. L. Brown, president of the Minneapolis & St. Louis, at Minneapolis, Minn., has resigned, on account of ill-health.

J. J. Pruett, general manager of the Mexico Northwestern at Ciudad Juarez, Chihuahua, Mexico, has been elected vice-president.

Richard Frank Malone has been elected auditor of the Kansas City Northwestern, with headquarters at Kansas City, Kan. He was born at Marshalltown, Ia., in January, 1870. After leaving high school he entered railway service with the Iowa Central in a clerical capacity in 1886. In 1889 he was appointed chief clerk on the Chicago Great Western, and in 1893 was promoted to auditor of passenger accounts. From 1900 to 1910 he was assistant general passenger agent of this same company, and then resigned to go into the real estate business in St. Paul, Minn. He returned to railway work in 1913, being appointed secretary and traffic manager of the Minneapolis & Northern, with office in Minneapolis, Minn. For the past three years he has been in business for himself at St. Paul, and now becomes auditor of the Kansas City Northwestern, as noted above.

Thomas Milton Schumacher, vice-president of the El Paso & Southwestern System, has been elected president, with headquarters at New York. Mr. Schumacher was born on February 16, 1862, at Williamsport, Pa., and began railroad work in 1879 as a telegraph operator. He was later successively freight clerk, brakeman, fireman, bill clerk, cashier, chief clerk and contracting agent, and in 1891 was made chief clerk in the general freight office of the Union Pacific, at Omaha, Neb. In 1894 he was made general agent of that road at San Francisco, Cal. In 1899 he was elected vice-president and general manager of the Continental Fruit Express, and was then appointed traffic manager of the Oregon Short Line. In 1906, he was made general traffic manager of the railroads and industrial companies controlled by Phelps, Dodge & Company, in New York, which position he resigned on December 1, 1909, to accept the vice-presidency of the Denver & Rio Grande and Western Pacific railroads. He was appointed assistant director of traffic of the Union Pacific-Southern Pacific Systems on May 1, 1910, which position he resigned to become traffic manager of the American Smelting & Refining Company and its allied companies, also vice-president of the Nevada Northern and Bingham & Garfield railroads, from December, 1910, to October, 1912. On October 10, 1912, he was elected a director and vice-president of the El Paso & Southwestern System, which position he held at the time of his recent election as president of that system. Mr. Schumacher also served from October 29, 1913, to October, 1916, as chairman of the board of directors of the Chicago, Rock Island & Pacific Railway Company, and subsequently as chairman of the executive committee of the same road.

T. M. Schumacher

D. P. Williams, announcement of whose appointment as assistant general counsel of the Pittsburgh, Cincinnati, Chicago & St. Louis, with headquarters at St. Louis, Mo., has previously been made in these columns, was born at Terre Haute, Ind., June 26, 1875. After leaving high school he entered Cornell University, from which institution he graduated in June, 1898, with the degree of bachelor of law. He began private legal practice

at Indianapolis, Ind., on October 1, 1898, but occasionally served in a minor capacity and without title under the counsel to the receiver of the Terre Haute & Indianapolis. On January 1, 1905, when this company, together with several other properties, was merged into the Vandalia, he was appointed district solicitor of the new road, and was promoted to assistant counsel on July 1, 1907, which latter position he held up to February 1, 1916, when he was appointed general solicitor of the Vandalia, succeeding John G. Williams, retired. His present appointment as assistant general counsel became effective on the recent consolidation by which the Pittsburgh, Cincinnati, Chicago & St. Louis absorbed the Vandalia.

Arthur John Hills, whose appointment as assistant to the executive of the Canadian Northern System, with headquarters at Toronto, Ont., has already been announced in these columns, was born on February 15, 1879, at Toronto, Ont., and was educated at Ridley College, also at Upper Canada College, and at the University of Toronto. In April, 1899, he began railway work in the construction department of the Manitoba & South Eastern, now a part of the Canadian Northern System, as a storekeeper and material clerk. He was transferred to the operating department in July, 1901, as a clerk in the general superintendent's office at Winnipeg, Man. From March, 1903, to January, 1908, he served on the staff of the third vice-president at Toronto, Ont., and then was appointed superintendent of the Canadian Northern Ontario. In July, 1914, he was appointed general superintendent of the Canadian Northern System, Ontario Lines, and on February 10, 1917, he was promoted to the newly created position of assistant to the executive, with headquarters at Toronto, as above noted. In addition to the executive work the office will handle statistical returns to the government, also to commissions, financial publications, etc., and statistical data for the Canadian Northern System officers.

George H. Steinberg, paymaster of the Terminal Railroad Association of St. Louis, with office at St. Louis, Mo., has been elected treasurer of that corporation with the same headquarters. He was born in 1846 and entered the service of this company in April, 1877, at the age of 21 as a collector on the upper roadway of the Eads Bridge. About 23 years ago he was appointed paymaster in chief, with jurisdiction over all the company's subsidiary properties. He held this latter position at the time of his present election as treasurer, succeeding Frederick C. Daab, deceased.

G. H. Steinberg

James Douglas, president of the El Paso & Southwestern System at New York, has resigned as president and has been appointed chairman of the board of the El Paso & Southwestern Company.

Louis Stephen Cass, president and builder of the Waterloo, Cedar Falls & Northern, with office at Waterloo, Ia., has been appointed receiver of the Kansas City Northwestern, with headquarters at Kansas City, Kan. He was born in Vernon county, Wis., May 6, 1865. Upon completing his preliminary education he took short courses in the Iowa Teachers' College, Cedar Falls, Ia., and at the Wallace Business College, La Crosse, Wis. In 1883 he entered railway service as a brakeman on the Chicago, Milwaukee & St. Paul. Subsequently he became a brakeman, conductor and station agent in turn on the Dubuque & Dakota, and later conductor and trainmaster on the Minnesota & Northwestern. He then went to the Chicago Great Western and became in succession freight solicitor, division freight agent, superintendent, assistant to general manager and third vice-president. Later when receivers were appointed for this company he became general traffic manager. He resigned this latter connection to build the Waterloo, Cedar Falls & Northern, of which he is at present the president. His appointment as receiver of the Kansas City Northwestern by Judge Hoops became effective February 26, 1917, succeeding B. F. Bush, who was operating this company as a part of the Missouri Pacific System.

Operating

J. W. Doyle, division superintendent of the Chicago & North Western, with headquarters at Baraboo, Wis., has resigned to go with a contracting company.

C. E. Leverich has been appointed superintendent of the Montana division of the Great Northern, with office at Havre, Mont., succeeding A. K. Stone, assigned to other duties.

O. S. Lamb has been appointed superintendent of the Kansas City Northwestern, with headquarters at Kansas City, Kan. This road was formerly a part of the Missouri Pacific.

Ben L. Allen, chief engineer of the Colorado, Kansas & Oklahoma, at Scott City, Kan., has been appointed superintendent and treasurer, succeeding F. S. Yantis, assigned to other duties.

W. A. Whitney, superintendent of transportation of the Union Pacific, with office at Omaha, Neb., has been appointed general manager of the Ogden, Logan & Idaho, with headquarters at Ogden, Utah.

H. E. Van Slyke, chief despatcher of the New York Central at Youngstown, Ohio, has been appointed trainmaster on the Franklin division, with headquarters at Youngstown, vice J. J. Crowley, taking service with another company.

J. W. O'Brien, superintendent of the Lake Erie & Western, with office at Muncie, Ind., has been transferred to Peru, Ind., succeeding M. P. Deniston, assigned to other duties. A. J. Smith, roadmaster at Tipton, Ind., has been appointed superintendent at Muncie, succeeding J. W. O'Brien. In addition to the usual duties of superintendent, Mr. Smith will also have charge of maintenance of track and roadway, reporting direct to the chief engineer.

George F. Everitt, announcement of whose appointment as superintendent of the Kansas City, Mexico & Orient, with headquarters at Wichita, Kan., has been previously made in these columns, was born at New London, Ohio, May 12, 1870. He entered railway service in August, 1888. After working in this and various other capacities on several western lines he was appointed chief despatcher on the Oklahoma division of the Kansas City, Mexico & Orient at Wichita. While serving as chief despatcher he also assumed the duties of trainmaster. In July, 1916, he was promoted to acting superintendent, with the same headquarters, which latter position he held at the time his present appointment, as noted above, became effective. He succeeded A. H. Dickinson, resigned to engage in other business.

Traffic

R. M. Ritchey has been appointed general agent of the Union Pacific, with headquarters at Topeka, Kan.

W. J. Doyle has been appointed industrial commissioner of the Gulf Coast Lines, with headquarters at Kingsville, Tex. This is a newly-created position.

G. H. Westcott has been appointed general freight and passenger agent of the Copper Range, with headquarters at Houghton, Mich., succeeding C. W. Marquardt, deceased.

J. B. Graham, soliciting freight agent of the Gulf Coast Lines at New Orleans, La., has been appointed commercial agent, with office at Baton Rouge, La., succeeding J. R. MacLeod, resigned.

T. H. Mercer has been appointed commercial agent of the Southern Railway System, with office at San Antonio, Texas, vice L. R. Gardner, resigned to accept service with another company.

E. H. Campbell has been appointed general freight and passenger agent of the Kansas City Northwestern, with headquarters at Kansas City, Kan. This road was formerly a part of the Missouri Pacific.

W. A. Cunningham, city passenger agent of the Canadian Northern at Montreal, Que., has been appointed division freight and passenger agent of the Halifax & Southwestern, with office at Halifax, N. S., succeeding P. Mooney, promoted.

W. C. McCormick, division freight and passenger agent of the Southern Pacific, Texas Lines, with headquarters at El

Paso, Tex., has been appointed assistant general freight and passenger agent, with the same headquarters. A. R. Atkinson, division freight and passenger agent at San Antonio, Tex., has been appointed assistant general freight and passenger agent, with headquarters at the same point.

W. S. Smith, traveling freight agent of the Gulf Coast Lines, with headquarters at Houston, Tex., has been appointed commercial agent of the New Orleans, Texas & Mexico, with office at San Antonio, Tex., succeeding J. B. Burns, resigned. H. H. Scott has been appointed traveling freight agent at Houston, Tex., succeeding W. S. Smith, promoted.

Mark Fenton, who has been appointed assistant general development agent of the Illinois Central, with office at Chicago, as has already been announced in these columns, was born at Webster City, Ia., on February 27, 1874. He entered railway service with the Illinois Central in September, 1890, as an agent's clerk. Up to 1893 he was a telegraph operator at various points along the line in Iowa, and from that time up to December, 1906, he was station agent at different places in Iowa, Illinois and Wisconsin. He was then appointed traveling freight agent, with headquarters at Bloomington, Ill., and in October, 1909, was advanced to traveling industrial and immigration agent, with office at Chicago. He continued to hold that position until his appointment as assistant general development agent became effective.

John C. Clair, whose appointment as general development agent of the Illinois Central, with office at Chicago, has already been announced in these columns, was born at St. Armand, Que., on October 18, 1861. He was educated in the Canadian primary schools, and later attended St. Albans Academy at St. Albans, Vt. In 1880 he was employed by the Central Vermont at St. Albans. From 1885 to 1893 he was division freight agent for the Cheshire Railroad, and later its successor, the Fitchburg Railroad, now a part of the Boston & Maine, with office at Bellows Falls, Vt. In 1893 he was appointed traveling agent in New England and Canada for the Illinois Central, being later promoted to New England agent, with office at Boston, Mass. From 1897 to 1903 he was industrial commissioner, with headquarters at Chicago. On April 1, 1911, he was appointed industrial and immigration commissioner, with the same headquarters, which position he held at the time his appointment, as noted above, became effective. The development bureau, of which he is the head, is a newly created department.

J. C. Clair

Engineering and Rolling Stock

O. F. Dalstrom, chief draftsman in the bridge department of the Chicago & North Western at Chicago, Ill., has been appointed bridge engineer with the same headquarters.

F. H. Hardin has been appointed master mechanic of the Adirondack division of the New York Central ,with headquarters at Utica, N. Y., in place of C. F. Deaner, assigned to other duties.

W. Y. Cherry, enginehouse foreman of the Pennsylvania Lines West of Pittsburgh at Allegheny, Pa., has been appointed master mechanic of the Grand Rapids & Indiana, with office at Grand Rapids, Mich.

L. A. Mattimore has been appointed master mechanic of the Arizona division of the Atchison, Topeka & Santa Fe Coast Lines, with headquarters at Needles, Cal., vice A. G. Armstrong, transferred, as master mechanic to the Los Angeles division, with headquarters at San Bernardino, vice I. C. Hicks, promoted.

D. J. McCuaig, general foreman of the Grand Trunk, at Ottawa, Ont., has been appointed acting master mechanic of the Ontario lines, with headquarters at Toronto, in place of W. G. Sealy, assigned to other duties.

C. C. Cook, division engineer of the Pittsburgh division of the Baltimore & Ohio at Pittsburgh, Pa., has been appointed district engineer maintenance of way of the West Virginia district, with office at Wheeling, W. Va.

Oscar F. Dalstrom, chief draftsman of the Chicago & North Western, with office at Chicago, Ill., has been appointed bridge engineer, with the same headquarters. He was born at Wyanet, Ill., August 15, 1871, and graduated from the Rensselaer Polytechnic Institute in 1901. In June, 1906, he entered railway service with the Chicago & North Western as a draftsman in the bridge department, prior to which time he had been employed for several years by the Pennsylvania Steel Company as a bridge draftsman and shop inspector on bridge work. On June 1, 1909, he was appointed chief draftsman, which position he filled up to February, 1915, when he assumed also the duties of the office of bridge engineer, vacated at that time by W. C. Armstrong, who resigned to become chief engineer of the St. Paul Union Depot Company. His assumption of the title of bridge engineer became effective March 1, 1917.

John M. Weir, whose appointment as chief engineer of the Kansas City Southern, with office at Kansas City, Mo., was announced in these columns two weeks ago, was born in Ireland, July 31, 1879. He first entered railway service with the Illinois Central in June, 1899, as a track apprentice, and up to March, 1907, passed through various positions until he became resident engineer in charge of construction. He then resigned from this company to assume charge of the construction of a small railroad being built in Canada. After the completion of this undertaking, about nine months later, he returned to the United States and secured employment with the St. Louis-San Francisco as assistant engineer, being assigned to construction work in connection with the new shops then being erected at Springfield, Mo. Subsequently he was made assistant engineer in the chief engineer's office in charge of construction of the Gainesville & Northwestern in the state of Georgia, after the completion of which he entered the valuation department of the Chicago, Rock Island & Pacific. Shortly thereafter he was appointed assistant engineer of track of this company's Chicago terminals and also assistant engineer in charge of terminal valuation. In June, 1916, he was appointed division engineer of the Kansas City Southern, with office at Pittsburg, Kan., which latter position he held at the time his present appointment became effective. He succeeds C. E. Johnston, recently promoted to general manager.

Purchasing

F. E. Carrero has been appointed local purchasing agent in New York City for the Constitutionalist Railways of Mexico, with headquarters at No. 11 Broadway.

OBITUARY

J. H. Hoyt, general counsel of the Hocking Valley at Cleveland, Ohio, died at St. Augustine, Fla., on March 21, at the age of 64.

James Parker Harrison, purchasing agent for the Louisville & Nashville, at Louisville, Ky., died recently at his home, in that city. He was born in Sussex county, Virginia, and had been in the employ of the Louisville & Nashville for more than 30 years. For 12 years he served as assistant purchasing agent and in November, 1916, was promoted to purchasing agent.

Willard Thomas Block, formerly president of the Chicago, Fort Madison & Des Moines, which is now a part of the Chcago, Burlington & Quincy, died March 17, at his home in Chicago. He was born on January 6, 1853, at Columbia, Pa., and began railway work in 1867 with the Philadelphia & Reading and later served on various roads including the Hannibal & St. Joseph and the Wisconsin, Iowa & Nebraska. He subsequently was president of the Chicago, Fort Madison &. Des Moines, also president of the Chicago & Southwestern, and promoted numerous

enterprises including the organization of the Grant Locomotive Works.

John Hickey, formerly superintendent of motive power, machinery and rolling stock of the Northern Pacific, with office at St. Paul, Minn., and prior to that master mechanic of the Milwaukee, Lake Shore & Western, died at his home in Salt Lake City on March 7. He was born in Ohio in 1852 and graduated from the Hoboken School of Technology as a mechanical engineer. At one time he was appointed superintendent of the Northern Pacific at St. Paul, Minn., and later was transferred with the same title to Tacoma, Wash. After serving this company as superintendent of motive power he accepted a position with the Denver & Rio Grande as master mechanic, with which company he remained until 1904, when he retired from active service. At the time of his death he was consulting engineer of the Orem Electric and the Salt Lake & Utah.

Oscar G. Murray

Oscar G. Murray, chairman of the board of directors of the Baltimore & Ohio, whose death in Baltimore, Md., on March 14 was briefly noted in our issue of last week, was born at Bridgeport, Conn., in May, 1847, and began railway work in January, 1872, as a ticket agent on the Galveston, Houston & Henderson. He remained in the service of that road until July, 1880, serving consecutively as assistant general passenger agent, assistant general freight agent, and general freight and passenger agent. In August, 1880, he was appointed general freight and passenger agent of the Gulf, Colorado & Santa Fe. From December, 1885, to September, 1886, he was traffic manager of the Missouri Pacific lines in Texas and also during most of that period, traffic manager of the Texas & Pacific. From September, 1886, to October, 1888, he was freight traffic manager of all the Missouri Pacific lines with headquarters at St. Louis, Mo. He was then to November, 1892, freight traffic manager of the Cincinnati, Indianapolis, St. Louis & Chicago and its successor, the Cleveland, Cincinnati, Chicago & St. Louis and the Chesapeake & Ohio. He subsequently served as second vice-president of the same system. In February, 1896, he went to the Baltimore & Ohio as first vice-president. Later in the same month the Baltimore & Ohio went into the hands of receivers, and Mr. Murray was appointed one of the receivers, jointly with John K. Cowen. They rehabilitated the property and returned it to the company in April, 1899, and were finally discharged by the court as receivers in May, 1900, when Mr. Murray again took up the duties of first vice-president in charge of traffic. He remained in that position until January, 1904, when he became president and since January, 1910, had been chairman of the board.

Oscar G. Murray

Mr. Murray's will, probated at Baltimore this week, bequeaths the bulk of his estate—assumed to be nearly $1,000,000—to trustees for the establishment of the Oscar G. Murray Railroad Employees' Benefit Fund, for the relief of the widows and orphans of men who have died in the service of the Baltimore & Ohio Railroad, preference to be given to those living in Baltimore. The executors of the will are George H. Campbell, assistant to the president of the Baltimore & Ohio, and Francis L. Lee. The executors are bonded for $800,000. There are numerous specific bequests to employees, former employees and other friends.

HONDURAS RAILROAD ADOPTS WOOD AS FUEL.—Owing to the continued high price of coal the Honduras National Railroad has temporarily abandoned this article as a fuel, and is using wood cut along the line of the railroad.—*Commerce Report.*

Equipment and Supplies

LOCOMOTIVES

THE CHICAGO & NORTH WESTERN has issued inquiries for 50 locomotives.

THE CAMBRIA STEEL COMPANY has ordered 2 six-wheel switching locomotives from the Baldwin Locomotive Works.

THE PERUVIAN CORPORATION, Ltd. (Peru), has ordered one Mogul type locomotive from the Baldwin Locomotive Works.

THE TREMONT & GULF has ordered one Mikado locomotive from the Baldwin Locomotive Works.

THE ATLANTIC REFINING COMPANY, Philadelphia, has ordered one four-wheel locomotive from the Baldwin Locomotive Company.

THE COPPER RANGE has ordered 2 superheater Consolidation locomotives from the American Locomotive Company. These locomotives will have 22 by 28 in. cylinders and a total weight in working order of 197,000 lb.

FREIGHT CARS

THE COPPER RANGE is inquiring for 50 hopper cars.

THE SEABOARD AIR LINE is reported in the market for 1,000 box and 1,000 flat cars.

THE AMERICAN SMELTING & REFINING COMPANY is reported in the market for 50 hopper cars.

THE CHICAGO & NORTH WESTERN is inquiring for 2,000 100,000 lb. capacity composite gondola cars.

THE RUSSIAN GOVERNMENT has ordered 200 freight cars from the Canadian Car & Foundry Company.

THE HAVANA CENTRAL is reported in the market for 300 20-ton flat, 100 25-ton flat, 200 30-ton flat and 300 30-ton box cars.

THE DETROIT EDISON COMPANY has ordered 10 general service cars from the American Car & Foundry Company.

THE COLOMBIAN NATIONAL has ordered 20 box, 10 stock, 10 gondola and 10 flat cars from the American Car & Foundry Company.

THE MAINE CENTRAL has ordered 300 freight cars from the Standard Steel Car Company in addition to 250 reported in the *Railway Age Gazette* of January 19.

THE UNION TANK LINE has ordered 1,000 tank cars from the Standard Steel Car Company in addition to 1,000 ordered from the American Car & Foundry Company, as reported in last week's issue.

THE FLORIDA EAST COAST, reported in the *Railway Age Gazette* of March 9 as being in the market for freight cars, has ordered 150 flat and 100 fruit cars from the Mount Vernon Car Manufacturing Company.

THE NORFOLK SOUTHERN has ordered 250 box cars from the Mount Vernon Car Manufacturing Company, and has awarded a contract to the American Car & Foundry Company for the conversion of 250 gondolas into box cars.

PASSENGER CARS

THE SOUTHERN PACIFIC reported in the *Railway Age Gazette* of February 2 as being in the market for 15 60-ft. baggage cars, 15 70-ft. baggage cars, 6 69-ft. baggage and mail cars and 5 75-ft. dining cars, has ordered these cars from the American Car & Foundry Company.

IRON AND STEEL

THE CHICAGO & NORTH WESTERN has ordered 577 tons of steel from A. Bolter's Sons Company for a machine shop at Chicago.

Supply Trade News

S. S. Shields, formerly general road foreman of the Atlantic Coast Line, has been appointed mechanical expert of the Galena Signal Oil Company.

Marburg Brothers, Inc., manufacturers of several railway specialties will remove its New York office from 1790 Broadway to 90 West street, on April 1.

C. S. Bilyeu, formerly connected with Hildreth & Co., engineers, of New York, has recently become associated with the Gulick-Henderson Company's organization of inspecting engineers, and will be located in the general office in New York.

E. J. Caldwell, in charge of the railroad sales department of the Barrett Company at Chicago, has been promoted to the position of manager of the general railroad sales department, with headquarters in New York, succeeding E. H. Poetter, who has been placed in charge of the export department.

The Idaho Southern, which discontinued operation some time ago and which runs from Gooding, Idaho, to Jerome, and the Milner & North Side, another short line extending from Milner, Idaho, to Oakley, both roads comprising a total of about 50 miles, have been purchased by the Walter A. Zelnicker Supply Company of St. Louis, Mo. The roads, which were built only a few years ago by Pittsburgh capital, it is said, will be dismantled, and all the ties, rails, spikes and other equipment sold.

Westinghouse Electric & Manufacturing Company

W. S. Rugg, formerly district manager of the New York office of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the railway department, with headquarters at East Pittsburgh, succeeding Charles S. Cook. Mr. Rugg was born at Broadhead, Wis., and is a graduate of Cornell University. His connection with the Westinghouse company dates back to the early days when the company had its plant at Garrison Alley in Pittsburgh. He was later transferred to the Chicago office, and in 1901 was again transferred to the New York office as a special engineer. In 1909 he became district manager of the New York office, which position he has held until this time. Mr. Rugg has been prominently identified with the work of the American Institute of Electrical Engineers, serving for a time as one of its managers.

W. S. Rugg

E. D. Kilburn, manager of the power department of the New York office of the Westinghouse Electric & Manufacturing Company, has been appointed district manager of this office, to succeed W. S. Rugg. Mr. Kilburn is also a graduate of Cornell University. Immediately after leaving college he became identified with the Westinghouse Electric & Manufacturing Company at East Pittsburgh, later being transferred to the Syracuse office. Afterwards Mr. Kilburn entered the employ of the Westinghouse Machine Company, with headquarters at New Haven, Conn., from which position he was transferred in 1915 to the New York office of the Westinghouse Electric & Manufacturing Company, to become manager of the power department. In November, 1916, his duties were enlarged to include the management of the railway and lighting department of this office.

E. P. Dillon, formerly assistant to manager of the railway and lighting department at East Pittsburgh, has been appointed manager of the power division of the New York office. Mr. Dillon is a graduate of the University of Colorado. Prior to his connection with the Westinghouse Electric & Manufacturing Company in 1909 he was associated with the Colorado Springs Light & Power Company, Colorado Springs, Colo.

J. L. Bacon has been appointed mechanical representative of the Economy Devices Corporation in charge of eastern territory, with headquarters in New York. Mr. Bacon was born October 10, 1886, at Toledo, Ohio. He was educated in the Toledo public schools and at Cornell University. He commenced railroad work as a clerk in the office of the division superintendent of Pennsylvania Railroad at Toledo. Later he served four years as special apprentice in the General Electric Company at Schenectady, N. Y. Leaving the General Electric Company he then spent the next year in the operating department of the Interborough Rapid Transit Company, New York. The following five years he was employed in the mechanical department of the New York Central, and leaves the latter company to take up his new duties.

United States Steel Corporation

The United States Steel Corporation in the fiscal year 1916 had gross receipts of $1,231,473,779 as compared with receipts in 1913, the best previous year, of $796,894,229. After all charges including expenses, interest, depreciation and dividends of 7 per cent on the preferred stock there were net earnings of no less than $246,312,053, equal to 48.46 per share of common stock. Dividends on the latter totaled 8¾ per cent, leaving a surplus for the year's operations of $201,835,584, a sum almost $55,000,000 larger than the largest net operating earnings of any previous year.

The corporation's balance sheet at the close of business on December 31, 1916, showed resources in excess of the two billion mark, $2,083,027,000. Of this amount no less than $501,150,873 was current assets as compared with current liabilities of only $92,942,436, leaving excess current assets of $408,208,437, an increase of $136,087,872 over 1915. Cash on hand totaled $148,394,761, an increase of over $54,000,000 from the previous year.

Expenditures made by the corporation last year for maintenance and renewals amounted to $69,392,627, an increase of $26,025,983 over 1915. The charges to and allowances from gross earnings to cover exhaustion of minerals, deterioration rising from wear and tear of improvements and for obsolescence was $104,576,379, as compared with $72,957,987 in 1915. The book valuation of manufacturing and operating materials, supplies and semi-finished and finished products on December 31 stood at $181,901,004, an increase of $20,787,104.

The expenditures made during the year by all the companies of the steel corporation and chargeable to capital account, for the acquisition of additional property and for additions and extensions were $64,806,648.

At the close of 1916, the amount unexpended on authorized appropriations for extensions and betterments, was approximately $137,000,000. About $100,000,000 of this will be spent this year.

The total payroll for 1916 amounted to $263,385,502, an increase of $86,584,638, or 49 per cent over the previous year. The average number of employees was 252,668, this being 60,000 more than last year.

During 1916 the steel corporation paid off a total of $12,993,056 of bonds, mortgages and purchase money obligations. Of this $9,641,000 were redeemed through the sinking funds of the mortgages securing the bonds.

The corporations produced in 1916, 33,355,169 tons of iron ore as against 23,669,676 tons in 1915. It manufactured 18,901,962 tons of coke, mined 6,162,340 tons of coal, quarried 7,023,474 tons of limestone and its blast furnace products totaled 17,607,637 tons. The production of Bessemer and open hearth ingots was 20,910,589 tons and rolled and other finished steel products totaled 15,460,792 tons. This last figure included 1,533,681 tons of rails, this total comparing with 1,129,832 tons in 1915 and 1,927,745 tons in 1913. The corporation also produced 10,425,600 barrels of cement. Only about 16 per cent of the corporation's business was for export.

Chairman E. H. Gary in his report to the stockholders said in part:

"The active demand for iron and steel products, for both

the domestic and export trade, which prevailed at the opening of the year 1916, referred to in last year's annual report, continued during the entire year. These demands exceeded the capacities of the mills, and consequently, prices advanced throughout the year. The tonnage of unfilled orders of the subsidiary companies at December 31, 1916, was 11,547,286 tons of rolled steel products, the highest total ever recorded in the history of the corporation and exceeding by 3,741,066 tons or 47.9 per cent the unfilled tonnage at close of 1915. The character of the order book is excellent. The bulk of the tonnage covers the needs of buyers for definitive contract work or their requirements for operation and maintenance, thus encouraging the belief that the operation of the mills at their full capacity will be continued for at least the greater part of 1917. The export sales were for cash and domestic sales were either for cash or on 30 to 60 day terms, in accordance with the custom of the trade as to various commodities. Collections have been unusually good."

The balance sheet follows:

Assets		Liabilities	
Prop. acct.	$1,472,622,732	Common stock	$508,302,500
Mining royalties	43,603,644	Preferred stock	360,281,100
Def. chg. to op.	1,618,063	Sub. cos.	505,042
Bond sinking fund	1,283,728	Bond and deb. debt	603,471,027
Investments	3,548,203	Mortgage	902,289
Inventory	181,901,005	Notes	24,925,557
Accts. rec.	83,441,821	Current accts. pay.	41,065,936
Bills rec.	5,146,806	Accrd. tax	22,171,540
Agents' bal.	1,059,102	Accrd. int., etc.	8,150,965
Misc. secur.	40,337,583	Pfd. div.	6,304,919
Cont. ins., dep. fds., etc.	59,199,796	Com. div.	15,249,075
Time bank depos., etc.	40,869,794	Sun. res. funds	55,337,108
Cash	148,394,761	Appr. surp.	55,000,000
		Undiv. surp. U. S. Steel and subs.	381,360,913
Total	$2,083,027,058	Total	$2,083,027,058

TRADE PUBLICATIONS

Wheels.—The American Steel Foundries, Chicago, Ill., has issued a very attractive and artistically illustrated pamphlet on the evolution of the wheel. It is written in the form of a poem, and briefly describes the development of the wheel as the means of transportation, and closes with a description of the Davis steel wheel and its advantages.

Flange Oilers.—The Detroit Lubricator Company, Detroit, Mich., has issued a catalogue treating of the Pendulum type of flange oilers. Part one is devoted to a description of the attachment and the second part treats on proper installation. A second publication called catalogue No. 37 L contains 64 pages and deals at length with the Bulls Eye locomotive lubricator and locomotive specialties.

Track Service Cars.—The Railway Motor Car Company of America has issued a 12-page booklet describing the application of a new system of power transmission to railway motor cars for use by section and other gangs. Attention is called to the application of these cars as power units for labor saving track tools, while the extension of the same system to larger inspection and passenger cars is also illustrated.

Standardized Metal Caging.—The Mitchell-Tappen Company has issued a 12-page booklet known as Bulletin No. 14, describing its standardized metal caging, which is a form of readily attached reinforcement for surrounding beams, columns, girders, etc., to be fireproofed or protected with concrete. Diagrams are given showing the methods of applying this reinforcement, and numerous photographs illustrate structures in which the caging has been used.

Prussian State Railways.—The Prussian minister of finance, Dr. Lentze, on introducing the ways and means bill, stated that the revenue of the state railways was materially influenced by the war; the receipts from passenger traffic decreased more and more, while those from freight traffic increased. Some military accounts for 1915 had to be carried forward to 1916, so 1915 showed a shortage of 96,000,000 marks ($23,040,000), which properly should be covered by the equalizing fund, but as this only showed a balance of 6,200,000 marks ($1,488,000), the difference, 89,800,000 marks ($21,552,000), had to be covered by a deficit loan, but it should be observed that interest and sinking fund on the capital invested had been provided prior to the above deficit. For 1914 the deficit was 116,000,000 marks ($27,840,000).

Railway Construction

Bibb Belt Railway.—A charter has been granted to this company in Georgia with $100,000 capital to build a railroad connecting the several railroads entering Macon, Ga., and serving a number of manufacturing plants in Bibb county. The incorporators include W. B. Sparks, J. T. Moore, and S. M. Solomon, Sr.

Chicago & Illinois Midland.—A certificate of necessity and convenience has been granted this company for an extension of its line from Auburn, Ill., to Compro, a distance of 3⅓ miles. Contracts for the grading have been let to Keating Brothers, St. Louis, Mo., for the concrete bridge and culvert work to the Armstrong Engineering Company, Taylorville, Ill., and for the bridge and steel erection to the Wisconsin Bridge & Iron Company, Milwaukee, Wis. The grading will average about 10,000 cu. yd. per mile; the maximum grade will be .03 of one per cent, and the maximum curve 3 deg. Two interlocking plants and towers will be built at crossings with the Chicago & Alton and the Illinois Traction. The object of this extension is to make a connection with the Chicago & North Western. The cost is estimated at $75,000.

Hudson & Manhattan (Electric).—The governor of New Jersey has signed a bill authorizing the city of Newark to grant a franchise to this company to build an extension of its line from Military Park to the Public Service Company's terminal building.

Lehigh & New England.—Surveys have been made for a proposed new line from Nesquehoning, Pa., to Coalport, about five miles through Panther Creek valley. A bridge is to be built over the Lehigh river at Coalport.

Milwaukee Western (Electric).—This holding company was incorporated recently in the state of Delaware with $2,750,000 capital to take over the control of the Milwaukee Western Electric Railway. The construction of the first section of the line to Fox Lake, Wis., it is understood, will be under way soon. The plans call for building a line from Milwaukee, Wis., northwest via Hustisford, Juneau and Beaver Dam to Fox Lake with a branch from Sussex south via Pewaukee to Waukesha in all, about 74 miles. The directors of the new company include A. P. Keltzsch, W. O. Vilter, Milwaukee; J. E. Steel, Olderly; A. F. Ryder, Juneau; G. Meissner, Oconomowoc; H. C. Kelling, Milwaukee; J. H. Bach, Chicago.

North Bend Mill & Lumber Company's Road.—This company's forces are building a steam lumber road about five miles long in Coos county, Ore. The road will run through what is known as Davis Slough. There will be one pile trestle about a mile long.

Oklahoma Union (Electric).—This company has awarded a contract to the Interurban Construction Company, Tulsa, Okla., for the construction of a new electric interurban running from Tulsa to Sapulpa by way of West Tulsa and Red Fork, a distance of 14 miles. No special engineering difficulties will be encountered.

Ringling & Oil Fields.—This company, operating a steam line from Ringling Junction, a point on the Oklahoma, New Mexico & Pacific, to New Healdton, Okla., 6.74 miles, is awarding contracts at New Healdton for the extension of its line from that point north eight miles to the Fox oil fields. Work is to begin at once. There will be approximately 20,000 cu. yd. of grading per mile, the maximum grade is 1 per cent and the maximum curve 4 deg. There will be two small steel and concrete bridges. A combination freight and passenger station, 40 ft. by 286 ft., is nearing completion at New Healdton. John Ringling, president, 636 Fifth avenue, New York City, and Joseph Harrison, chief engineer, New Healdton, Okla.

Roscoe, Snyder & Pacific.—This company has under consideration plans for building an extension from the present terminus at Fluvanna, Texas, southwest to Gail, about 24 miles. It is understood that the line may ultimately be extended west to

Lamesa. The company now operates a line from Roscoe, Texas, where connection is made with the Texas & Pacific, northwest to Fluvanna, 50 miles.

SAN ANTONIO & ARANSAS PASS.—The question of building an extension from the present southern terminus of the branch line at Fulfurrias, Texas, south towards the Rio Grande is now under consideration. It is understood that residents of the towns along the proposed route will donate money and land in aid of the project.

SAND SPRINGS.—This company operating a part-steam and part-electric railway about 22 miles long will let contracts within 90 days for an extension from Sand Springs, Okla., to Hominy and thence to a point on a proposed extension of the Atchison, Topeka & Santa Fe. The estimated distance of the extension is 41 miles, which, with another to be made by the Santa Fe, will approximate 110 miles in all. The estimated cost of this undertaking is $3,000,000. The grading, bridging and concrete work will be let by contracts, but track laying and other work preparatory to operation will be done by the company's own forces.

UNION PACIFIC.—This company is enlarging its freight yards at Junction City, Kan., by the construction of additional yard tracks. The work is being done by the company's own forces. The estimated cost of these improvements is $24,000.

RAILWAY STRUCTURES

ALCOA, TENN.—A contract for the construction of a frame combination station, 123 ft. by 41 ft. at Alcoa, Tenn., the terminus of the Tennessee & Carolina Southern Railway, has been let by the Southern Railway to J. M. Stair & Sons, Knoxville, Tenn.

HAZLETON, PA.—The Lehigh Valley has given a contract to the R. D. Richardson Construction Company, Scranton, Pa., for building a new freight terminal in Hazleton. The work will include a new brick freight station, 40 ft. wide and 300 ft. long, with a second story, 40 ft. by 50 ft., for offices, and there will be a large concrete freight transfer platform. The station will be located along the west side of Vine street and south of the present freight station. The plans call for ample team tracks, paved driveways, etc.

JACKSONVILLE, FLA.—A contract has been given by the Jacksonville Terminal Company to Irwin & Leighton, Philadelphia, Pa., to build the terminal passenger station, baggage building and subway at Jacksonville. The buildings will be of structural steel, concrete, brick and limestone construction and will cost $750,000.

NORTH PLATTE, NEB.—The Union Pacific has awarded a contract to James F. Stewart & Co., of St. Louis, Mo., for the erection of a new brick and stone passenger station at this point. The contract price is $120,000. Work will be begun at once.

OMAHA, NEB.—The Union Pacific has awarded a contract to Westinghouse, Church, Kerr & Co., New York City, for the erection here of a brick and steel power house for a central power station. The building will be of brick and steel with concrete foundation, 76 feet wide by 209 feet long. Work will be started at once. The cost of this undertaking is stated to be $450,000.

SPOKANE, WASH.—The Spokane & Inland Empire will shortly award contracts for the erection of three 125-ft. double track Howe truss spans over the Spokane river at this point. About 600,000 feet of lumber will be required for this undertaking. The estimated cost is $50,000. It has not yet been decided when bids will be called for the work.

MOSTY TUNNEL OPENED FOR TRAFFIC.—The second Mosty tunnel, near Jablunkau, Austria, in the Carpathians, has been opened for traffic. The completion of this tunnel has created a double track railway connection from Breslau, Germany, through Hungary to the Balkan States.

FRANCE LIMITS RAILROAD TRAFFIC.—With a view to reducing railway passenger traffic Transport Minister Herriot has published a decree suppressing all round-trip tickets, family tickets, excursion tickets and special tickets for seaside resorts. At the same time the amount of baggage other than personal is limited to 200 pounds for each passenger.

Railway Financial News

BOSTON & MAINE.—A reorganization plan for the Boston & Maine has now been virtually agreed to by representatives of the Boston & Maine and leased line interests. The plan provides for the issuance of $12,324,000 new preferred stock to be sold for cash. Under the new plan 60 per cent of the $12,324,000 new stock is to be first preferred and 40 per cent convertible preferred. The modified plan reduces the subscription by the common stock from $40 to $30 per share, while the preferred stockholders pay $15 per share, for which first preferred and convertible preferred are given. The convertible preferred is exchangeable into common, par for par.

The only compulsory phase is that if a common stockholder does not elect to subscribe for the new preferred stocks, he must pay an assessment of $5 per share, or surrender 20 per cent of his present holdings. The preferred stockholders must pay an assessment of $2.50 per share, or surrender 10 per cent of his holdings. The leased line holders will continue to receive the same amount in dividends that they are now guaranteed as a fixed interest charge—from 5 per cent to 10 per cent, according to the stipulations of the specific lease.

The plan also provides for the issuance of $12,500,000 5 per cent bonds, the sale of which, together with the funds received from the subscriptions to preferred stock, will permit of the liquidation of the present floating indebtedness of Boston & Maine and leased lines, amounting to $19,000,000, and to provide a working capital of $4,000,000 to which should be added present cash on hand.

LONG ISLAND.—Justice Lehman, who last spring heard the suit of Dick Brothers & Co., New York, as minority stockholders of the Long Island Railroad, against the Pennsylvania Railroad for $28,000,000, alleged to have been diverted from the Long Island treasury for the benefit of the Pennsylvania, has dismissed the suit. The court held that the expenditures were mainly for the benefit of the Long Island, and accordingly justified. The court said the attitude of the defendants was illustrated by the testimony of President Rea of the Pennsylvania, who said that his road built for 50 years in advance.

NEW YORK CENTRAL.—The Ohio Supreme Court has refused to allow the New York Central to join with the Michigan Central, Canada Southern and Canadian Pacific in jointly and severally guaranteeing payment of principal and interest on $2,000,000 bonds of the Toronto, Hamilton & Buffalo, and has ordered the Utilities commission to modify its order. James Pollitz and Clarence Venner, minority stockholders of the New York Central, appealed from a decision of Utilities commission, and their contention was upheld in part. The court held that the New York Central could guarantee bonds of its own companies, but no others. The Toronto, Hamilton & Buffalo is a 100-mile road on the Canadian peninsula between Lake Erie and Lake Ontario. Its $4,500,000 stock is divided between the New York Central lines and the Canadian Pacific.

TENNESSEE CENTRAL.—Press despatches from Nashville say that a bill is to be introduced in the Tennessee legislature authorizing the city of Nashville to issue $3,200,000 5 per cent bonds to provide funds for the purchase of the outstanding $4,014,000 bonds of the Tennessee Central, and to pay the upset price of $700,000 when the road is sold at foreclosure. The Southern Railway and the Illinois Central own the outstanding bonds, and would sell them, it is said, for $2,400,000.

BRITISH RAILWAY MEN LOST IN WAR.—Up to the present some 7,000 men from the Great Eastern Railway have joined the colors, of whom 429 have been killed or have died from wounds or sickness.—*The Engineer, London.*

RAILWAY REWARDS RED CROSS SOCIETY.—The North British Railway Company has made a gift of £100 ($486) to the British Red Cross Society, as an acknowledgment for the valuable services rendered by the society after the Ratho accident of January 3.—*The Engineer, London.*

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Canadian Officers of the Association

With the installation of John G. Sullivan as president of the American Railway Engineering Association yesterday, leadership of this organization has for the second time been placed in the hands of a resident of Canada. The first recipient of this honor was William McNab, who served as president several years ago.

Few associations have as close a bond of unity between their members in the United States and Canada as the Engineering Association. In fact, there is no line of cleavage between the members from these two countries. As far as the discussion on the floor of the convention is concerned, as widely varying viewpoints are expressed because of different local conditions in the United States as between those of residents of the States and Canada. This close relationship not only means much to the railways of the two countries which interchange traffic so freely, but enables one strong society to perform the work which might otherwise be done by two smaller organizations.

Clearance Diagram Adopted

The final adoption yesterday of the clearance diagram presented by the committee on Rules and Organization completes one of the constructive acts of this organization for which it deserves credit. For years there has been a definite demand for such a standard, but until last year railway men were unable to harmonize their differences. The lack of such a standard more than any other one consideration has led to activity on the part of state legislatures and commissions. It has frequently been stated by public officers that if the railways could agree upon a single standard sufficiently broad to fulfill the purpose for which it was desired many of the states would be glad to adopt the same standards. This diagram was first presented before the association last year. At that time there was a spirited discussion and much opposition was displayed. However, the essential dimensions were established last year and the diagram accepted yesterday presented these dimensions in graphical form. Because of the thorough discussion last year there was little opposition to the adoption of the diagram yesterday and the railways are now able to go before the regulatory bodies with definite evidence of the fact that they have endeavored to solve this problem in a reasonable manner.

New Specifications for Cement

With the general acceptance of the specifications for Portland cement, which were adopted by the convention yesterday for insertion in the manual, the specifications can be truly known as the "American Specifications for Portland Cement." Considering the number of bodies represented on the committee whose work made the new specifications possible, the general use of the specifications throughout the country is assured, and there will result a degree of standardization regarding cement which has no equivalent at the present time in any other building material. Considering the fact that the railways represent the largest single group of cement buyers,

the importance of the adoption of the specifications by this body is not to be underestimated, for while other associations have had a very large share in their formulation, their universal adoption would be impossible without the assistance and co-operation of the American Railway Engineering Association. The manufacturers should be given due credit for the co-operation which they have accorded the committee during the progress of the work, and they will in turn receive material benefits through the widespread acceptance of the specification. The benefit to the users, however, will be at least as great in proportion.

THE ATTENDANCE AT THE EXHIBIT

The efforts made by the exhibitors at the Coliseum this year to carry out their plans in the face of most discouraging conditions immediately preceding the exhibit have been amply rewarded. From the very beginning on Monday morning it was evident that the attendance would be surprisingly good. The official check at the end of the first day bore this out even more strongly, as it showed a total attendance of 3,442 as compared with 3,041 for the first day of the 1916 exhibit. The following table shows in detail the attendance record by days for the past three years, the figure for yesterday including the attendance up to 9 p. m.:

	1915	1916	1917
Monday	1,925	3,041	3,442
Tuesday	4,006	7,771	5,907
Wednesday	4,827	5,061	7,509
Thursday	5,876	4,574	5,494
Friday	2,025	.....	.....
	18,659	20,447	22,352

The exhibitors are naturally very much pleased with this outcome, particularly as many of them had felt at the end of last week that they would practically be obliged to go through the week with an attendance limited to men from Chicago and the immediate vicinity. Several supply men who have been attending the Appliance shows for many years are convinced that there has never been one with more satisfactory results to the exhibitors, taking into consideration the total attendance, the high proportion of engineering and signal department officers present and the interest manifested by these officers in the materials and devices on display.

While it has always been realized that many of the men in the lower ranks who can spend only a single day come to the exhibit regardless of either the R. S. A. or the A. R. E. A. meetings; the drawing power of the exhibit for higher officers was clearly demonstrated this year. Many signal men who were kept away from the R. S. A. meeting on Monday by the strike uncertainty came from considerable distances later in the week primarily to see the exhibit.

OBEY THAT IMPULSE

The exhibit of appliances at the Coliseum has closed. Those who were present have had ample opportunity to get the material from which to prepare a contest paper on what was learned at the exhibit. If you have not already acted on that impulse to enter the contest do it now. The rules do not require a discussion of every exhibit displayed. The division between maintenance of way and signaling cuts the task of covering the field practically in half. Further, the completeness of the discussion is only the third point to be considered in awarding the prizes. The two features of first importance are the practical value of the information which the writers present, based on their study of the exhibits, and the value of the suggestions offered to make the exhibit of greater benefit to railway men.

This contest, as previously announced, is being conducted jointly by the *Railway Age Gazette*, the "Railway Maintenance Engineer" and the "Railway Signal Engineer," all published by the Simmons-Boardman Publishing Company. Prizes of $50, $25 and $10, respectively, in each of the two main sections, will be awarded by boards of judges composed of railway officers, and a single prize of $60 is offered for the best paper covering the exhibit as a whole with the understanding that no individual will be awarded more than one prize.

In preparing these papers, it is desirable that the writers treat devices and materials by classes rather than as the product of individual manufacturers, and that the names of companies be used only when necessary to make the meaning clear. The contest is open to anyone employed in railway service. Papers may be of any length, not exceeding 2,500 words. They should be mailed to the Editor of the *Railway Age Gazette*, 608 So. Dearborn street, Chicago, not later than April 9, 1917.

PRESERVATION OF YELLOW PINE

The discussion of the report of the Committee on Grading Rules yesterday morning brought forth some fundamental facts concerning the selection, use and treatment of yellow pine lumber. The space available permits of only a brief abstract of the remarks of Mr. Frink, elsewhere in this issue, but he is to be commended for the exhaustive independent study which he has made of this subject and for the able manner in which he presented his conclusions to the committee. It is not often that the discussion of committee reports is based on such thorough preparation.

An enlightening feature of the discussion was the wide diversity of opinion expressed in the reports which Mr. Frink received from officers of railroads and lumber and creosoting companies as to the results secured with the treatment of the various species of yellow pine, and it is apparent that an agreement on the points in dispute will not be reached for some time. Dr. von Schrenk pointed out for the committee that the conclusions were in accord with the instructions received from the Board of Direction, and that modifications such as were suggested in the discussion could not be made without trespassing upon the field of other committees. However, in view of the points brought out in the discussion, the further consideration of this subject for another year should bring good results.

BALTIMORE AND OHIO PROMOTION

C. C. Cook, division engineer of the Pittsburgh division of the Baltimore & Ohio, with headquarters at Pittsburgh, Pa., has been promoted to district engineer maintenance of way of the West Virginia district, with headquarters at Wheeling, W. Va.

ENGINEERING RESERVE CORPS

Capt. C. L. Bent, retired, United States Army, spoke for a few minutes at the opening of the morning session yesterday, regarding methods of obtaining appointments in the reserve corps. He said that the members of the association were eligible for appointments as majors, captains, first lieutenants or second lieutenants and that the period of enlistment is five years. In time of peace the maximum service required is 15 days per year in encampment, while in time of war the men obligate themselves to perform any duty assigned by the president. He said that railway regiments are being organized in Chicago, New York and St. Louis.

Proceedings of A. R. E. A. Sessions on Thursday

Reports and Discussions on Several Subjects Including Masonry, Structures, and Wood Preservation. Closing Business

THE final sessions of the American Railway Engineering Association convention were held on Thursday. The morning meeting was called to order by President Baldwin at 9:30 and as two reports still remained to be presented at the noon hour, an afternoon meeting was called at 2:00 o'clock. Final adjournment was taken about 3:15. Abstracts of the reports of five committees which were taken up and the discussions on the various subjects considered are given below.

Report of the Committee on Masonry

CONCRETE piles may be properly divided into two classes: Pre-cast concrete piles and "cast-in-place" piles.

The more important advantages gained by the use of concrete piles are as follows:

(1) Foundations can be constructed above the permanent ground water level.

(2) On account of their size, the bearing power can be increased and fewer piles are necessary to carry a given load. This feature tends to reduce the required foundation area in most cases.

(3) Smaller foundations result in a lighter dead load and a consequent reduction in the number of piles.

(4) Piles may be placed nearer the points of greatest pressure on account of the smaller foundations and greater bearing power.

F. L. Thompson, Chairman

(5) Concrete piles may be used in trestles, making possible a permanent structure at a considerably less cost than the ordinary type of pier bridge where the height is such as to permit their use.

Pre-Cast Piles

There are many patented piles that are now available, each one having its particular advantages in some classes of work. The length, design and amount of steel reinforcement required depend upon the load which the concrete pile is to carry; the nature of the soil into which it is to be driven; whether the piles act as a simple column or whether skin friction may be obtained, and the amount of reinforcement necessary to permit safe handling.

The more common shapes used are the square, hexagonal and octagonal sections, depending upon the style of structure the piles are to carry. The square-shaped pile may best be used where a maximum top section is required to distribute the load. The hexagonal- or octagonal-shaped piles, by reason of their comparative constant diametric section, present the most suitable shapes for general conditions.

The straight pile should be used when the pile rests on solid rock or hardpan, or is driven through sand or other similar material which is subject to flow on account of future excavations or from other causes tending to cause the piles to act as a column. The tapered pile can advantageously be used where the soil is clay or similar material where skin friction will serve as a factor in the bearing power of the pile.

The cost of constructing concrete piles depends upon the requirements as to design and also on the manufacturing facilities. The cost of constructing and driving precast concrete piles varies from $0.75 to $2 per linear foot, with an average price of about $1 per foot, varying with the conditions, length and number of piles cast.

To obtain good results, piles should be seasoned not less than 30 to 40 days before handling and driving, depending upon the amount of driving expected and the season of the year when the piles are made.

Specifications for Constructing Concrete Piles

The piles shall be made in accordance with the dimensions shown on the drawings.

The workmanship and materials shall be in accordance with the Specifications for Plain and Reinforced Concrete and Steel Reinforcements, as embodied in the Manual, with the following modifications:

The coarse aggregate shall consist of material such as crushed stone or gravel, varying in size from ¼-in. to ¾-in. It shall be clean, hard, durable and free from all deleterious matter.

The proportions of the concrete shall be one part cement, two parts fine aggregate and four parts coarse aggregate.

The forms for concrete piles shall be made under the requirements for forms for concrete and reinforced concrete, as published in the Manual; they must be supported upon skids, spaced sufficiently close to prevent the sagging of forms. The forms are generally collapsible, the bottom left under the piles until seasoned sufficiently to permit turning upon the skids.

Concrete piles shall not be handled on the skids or moved to the site for driving, unless they have seasoned 28 days. All concrete piles must be handled carefully, avoiding all drops or heavy jarring while in a horizontal or inclined position.

Specifications for Driving Concrete Piles

Piling shall be protected while being driven with an approved cushion cap.

The driving or jetting of piles shall be governed by "Pile Driving—Principles of Practice," given in the Specifications for Workmanship for Pile and Frame Trestles in the Manual of the Association.

In driving, preference will be given to a steam hammer. Where a drop-hammer is permitted, a heavy hammer with a short drop shall be used.

Any pile injured in driving or driven out of place shall either be replaced by a new pile or pulled and redriven, as the case may be.

On sloping ground, and where necessary, a suitable hole shall be dug at the location of each pile to aid in holding it in proper position.

Before driving, the piles shall be carefully located and set to the line called for on the plan, and the pile driver leads held in proper position by means of guy lines. Unless otherwise called for on the plans, piles shall be driven as nearly as possible in a plumb position. Any pile out of plumb more than one-half inch per foot shall be pulled and redriven if so required by the engineer.

All reasonable efforts shall be made to drive the concrete piles to plan cut-off, the lengths of the piles having been determined by borings or test piles. Driving will be continued until this point is reached or until the following conditions are met. (Cases where driving is through soft soil to hard bottom or rock excepted.)

For a load of 15 tons, piles shall be driven to a point requiring not less than 5 blows to the last 2 in. of penetration, when driven with a No. 1 Vulcan steam hammer (weight of plunger 5,000 lb., drop 36 in.) or other hammer of like mechanical effect.

For a load of 25 tons, piles shall be driven to a point requiring not less than 8 blows to the last 2 in. of penetration when driven with a No. 1 Vulcan steam hammer (weight of plunger 5,000 lb., drop 36 in.) or other hammer of like mechanical effect.

Where it is not possible to drive concrete piles to plan cut-off, it will be necessary to remove a portion of the pile above this point, and, unless otherwise specified, a variation of 4 in. will be allowed above the plan cut-off for the inequalities of the tops of the piles. All loose parts of the head of cut-off piles shall be removed. Where reinforcement has to be cut off, it shall be done by a hack saw or oxy-acetylene torch.

"Cast-in-Place" Piles

"Cast-in-place" piles may be divided into the following groups:

(a) Piles which are formed by the driving of a collapsible steel mandrel encased with a spirally reinforced sheet-steel casing; withdrawing the steel mandrel after the required penetration is secured, and the filling of the steel casing or form left in the ground, with concrete.

(b) Piles which are formed by the driving of a cylindrical casing with a core as a protecting and driving point; removing the core; placing the charge of concrete using the core as a rammer to compress the surrounding soil at the base, thus forming an enlarged base to the pile; thence filling the casing with wet concrete and removing the casing and allowing the concrete to fill up the space caused by the removal of casing.

(c) Same as (b), except that the casing is driven with a protecting point left in the ground, the entire casing is filled with wet concrete, and the casing is then removed as above.

Under conditions where "cast-in-place" piles may be used, the main advantages over the pre-molded piles are as follows: (1) The length of the pile need not be definitely predetermined on account of being able to vary the lengths in driving as required. (2) Saving in labor and material on account of each pile being made the required length before concrete is placed, thus saving cut-offs. (3) The cost of handling materials is reduced. (4) The delay of awaiting seasoning before handling is eliminated. (5) The degree of penetration can be more accurately determined on account of the elastic cushion cap being unnecessary. (6) Saving in reinforcement against handling, which in most cases is eliminated.

The nature of all the construction of a "cast-in-place" pile makes it essentially a foundation pile and may not be a substitute for the original pre-cast pile in all cases. The expense of the moving and setting up the special equipment necessary for the various types makes them more economical on larger pieces of work than on those structures demanding a smaller number of piles.

In general, the various types of piling are either driven by companies owning or controlling the patented features or they are driven by contractors or others on a royalty basis. The diameter and shape of the piles vary with the type of pile used. Tapered round piles average an 8-in. tip and a diameter of 18 in. at 23-ft. depth, the straight piles are circular and have an average diameter of 17 in.

The cost will vary from $0.85 to $2 per linear foot with an average of perhaps $1, depending upon the number of piles driven and their lengths. Lengths are always measured from cut-off to tip of pile.

Loading of piles may be calculated from the same formula as that given for pre-cast piles, but as above stated, this can be more accurately determined in the "cast-in-place" piles.

The Cost, Appearance and Wearing Qualities of Various Methods of Surface Finish for Concrete

The sub-committee has prepared specifications for various methods of finishing concrete surfaces, which are herewith submitted, together with some additional information upon the subject assigned.

The color of untreated surfaces and of rubbed surfaces is due almost entirely to the cement used. With the other methods of treatment the color and appearance depend largely upon the aggregates and by proper selection and combination of these a variety of effects may be obtained. The coarser the aggregate, the coarser will be the texture of the finished surface. The smaller and more uniform

the aggregate, the more closely will the surface resemble natural stone. A mixture of crushed stone and gravel, because of the contrast between the angular surfaces of the stone and the round, smoother surfaces of the gravel, gives a more varied effect than either alone. Pleasing effects can be produced by using marble chips or other colored aggregate.

It is the general experience that all treated surfaces darken in time and in many cases begin to lose their neat appearance as soon as finished. A fruitful cause of unsightly discolorations is water seeping through the seam between two layers of concrete not deposited consecutively, causing unsightly discolorations, and many otherwise fine appearing surfaces have been marred on this account.

The use of special finishes is comparatively new among railroads and their wearing qualities therefore have not yet been fully determined. Rubbed finishes of the various kinds seem to have been most commonly used, and a number of roads report neat appearing surfaces in good condition after 3 to 8 and in one instance 15 years. These are about equally divided between cement bricks, carborundum bricks and wooden floats. One road of large experience obtains the best results by rubbing first with wooden floats and then with carborundum bricks, surfaces thus treated being very satisfactory in condition and appearance after 6 years.

Tooled surfaces are reported as showing absolutely no signs of deterioration after 6 years. Other roads report the same condition after 4 years' service.

Conclusions

For all work not requiring decorative treatment, a spaded finish is recommended as the most durable, the most readily applied and the most economical.

Coating with a wash of cement is not recommended.

Rubbing with carborundum bricks or wood floats is next to spading in ease of application and cost.

Tooling, alone or with rubbed margins and outlines, produces the most pleasing appearance, and where ornamentation is desired, these and the scrubbing methods are recommended.

Careful form work and continuous placing of the concrete are recommended as essential for all methods.

Specifications for Surface Finishes of Concrete

(I) General: 1. The forms shall be made of lumber dressed to a uniform thickness and width, or dressed and matched to a uniform thickness and width, or lumber lined with metal, or metal, carefully built to exact dimensions and shape, with close level joints, smooth inside surfaces and sufficiently braced and tied together to be unyielding. The inside surfaces shall be washed just before the concrete is placed. Where the smoothest surface practicable with all wooden forms is desired, the inside surface shall be coated with light paraffin oil, boiled linseed oil or other approved material.

2. The whole extent of a surface to be finished shall be built in one continuous operation. The decorative treatment of the structure shall be such as to permit this. Where a continuous operation is not possible the seam or joint between the concrete placed first and that placed later shall be made water-tight with sheet lead or other metal imbedded equally in the two deposits of the concrete, or by some other approved method.

3. The same brand of cement shall be used throughout the whole of any surface or structure.

4. Where margins, patterns or different finish from the remainder of the surface are required, the forms shall be removed at the proper time to permit these to be laid off and finished in the best manner for the method specified.

5. All work shall be finished free from streaks, discolorations or other imperfections that impair the appearance or life of the finish.

(II) Spaded Finish: 1. The coarse aggregate shall be carefully worked back from the form into the mass of the concrete with spades, fine stone forks, bars or other suitable tools so as to bring a surface of mortar next the form. Care shall be taken to remove all air pockets and to prevent voids in this surface.

2. After the removal of the forms all voids in the surface shall be filled with a mortar made of the same proportions of cement and sand as those of the concrete and rubbed smooth and even with the surface with a wooden float. A trowel shall not be used for this purpose.

(III) Rubbed Finish—Carborundum or Cement Bricks: 1. The coarse aggregate shall be carefully worked back from the forms into the mass of the concrete with spades, fine stone forks or other suitable tools, so as to bring a surface of mortar against the form. Care shall be taken to remove air pockets and to prevent voids in the surface.

2. The forms shall be carefully removed from the surface to be finished as early as practicable, all joint marks, projections and inequalities chipped off and all voids filled with a mortar made of the same proportions of cement and sand as those of the concrete. These surfaces shall then be thoroughly wet with water and while wet, rubbed to a smooth, uniform finish with a brick made of 1 part Portland cement and 2 parts or 2½ parts sand; or with a No. 3 Carborundum brick followed by a No. 30 or with a No. 24 Carborundum brick, as may be necessary to obtain the desired degree of smoothness.

3. No mortar or cement shall be applied except to fill distinct voids in the surface. Uneven places shall be smoothed by rubbing down and not by plastering. The surface shall be kept moist and protected from rapid drying for not less than three days.

(IV) Rubbed Finish—Wooden Floats: 1. The coarse aggregate shall be carefully worked back from the forms into the mass of the concrete with spades, fine stone forks or other suitable tools so as to bring a surface of mortar next the form. Especial care shall be taken to remove air pockets and to prevent voids in the surface.

2. The forms shall be carefully removed from the surfaces to be finished while the concrete is green, all joint marks, projections and inequalities chipped off and all voids filled with a mortar made of the same proportions of cement and sand as those of the concrete. The surfaces shall then be rubbed with soft wood floats and kept well flushed with water during the rubbing. When the desired finish is obtained the whole surface shall be thoroughly washed with water.

3. No mortar or cement shall be applied except to fill distinct holes or cavities. Uneven places shall be smoothed by rubbing down and not by plastering. The surface shall be kept moist and protected from rapid drying for not less than three days.

(V) Faced Surfaces: 1. The outside layer of the surface to be finished shall be composed of 1 part cement and 3 parts graded aggregate mixed to a stiff mortar. The aggregate shall be (description of aggregate) crushed to pass a sieve of ⅜ in. mesh and be retained on a No. 100 sieve. The cement and the aggregate shall each be measured carefully and accurately for each batch and all batches shall be gaged with the same amount of water and carefully mixed in the same manner and for the same length of time, in order to obtain uniform surfaces.

2. For vertical surfaces the above surface mixture shall be placed against the forms by skilled workmen (using metal slip plates, where practicable) in a layer not less than 1 in. thick, as the concrete is deposited, in order that the surface mixture shall form a part of the mass of the concrete. Care shall be taken to remove air pockets and to prevent voids in the surface. For horizontal surfaces the surface mixture shall be placed as the concrete is deposited and before the concrete has set and where possible troweled or floated to an even surface.

(VI) Unfaced Surfaces: 1. The surface concrete shall be of the same mixture as specified for the body of the structure. The cement and the aggregate shall be measured carefully and accurately for each batch and all batches shall be gaged with the same amount of water and carefully mixed in the same manner and for the same length of time, in order to obtain uniform surfaces.

2. The concrete shall be spaded or worked against the form so as to make a surface of uniform density, free from air pockets and voids, with both coarse and fine aggregates exposed.

(2. The concrete shall be spaded vertically against the forms only as much as will remove air pockets and prevent voids, care being taken not to force the coarse aggregate away from the form.)

(VII) Washed or Scrubbed Finish: 1. As soon as the concrete has hardened sufficiently, but while it is still green, the forms shall be carefully removed from the surface to be finished and all voids filled with the surface mixture. The surface shall then be scrubbed with water and brushes of stiff fiber or of wire, until the aggregate is sufficiently exposed and projects slightly, but not enough to injure its adhesion to the mass. The whole surface shall then be washed with water until thoroughly clean. If necessary in order to remove the film of cement from the surface of the exposed aggregate or to better bring out the color, the surface shall be washed with a solution of 1 part commercial hydrochloric acid and 2½ parts water applied with brushes of stiff vegetable fiber. All traces of the acid shall be immediately and completely removed by washing with water. After the final washing the surface shall be kept moist and protected from rapid drying for not less than 3 days.

(VIII) Acid Treated Finish: 1. After the forms are removed all voids shall be filled with the surface mixture. The surface to be finished shall then be washed with commercial hydrochloric or nitric acid diluted with water according to the age and hardness of the concrete. The strength of the solution shall be determined by trial on the work and shall only be such that the bond of the cement will be readily broken to the required depth. The solution shall be applied with stiff vegetable fiber brushes and the surface scrubbed until the aggregate is exposed to the desired amount.

2. As soon as the desired surface is obtained all traces of the acid shall be quickly and completely washed off with water to prevent its further action and the permanent discoloration of the surface.

Note.—For concrete that is but a few days old, a dilution of one part acid to six parts water may be sufficient. For concrete two weeks old a dilution of only two or three parts may be necessary.

(IX) Sand Blast Finish: 1. After the forms are removed all voids shall be filled with the surface mixture and left to harden as long as possible. All joint marks and projections shall be chipped off. The outside mortar shall then be cut away with a sandblast using a hard sand with angular grains. The nozzle shall not be larger than ⅛ in. diameter and shall be held close to the surface. Care shall be taken to cut all the surface to a uniform depth. The work shall preferably be done between ten and fourteen days after the concrete is placed.

(X) Tooled Finish: 1. The proportions of cement and fine aggregate shall be such as to produce a mortar of a density or hardness as nearly equal to that of the coarse aggregate as possible.

2. After the forms are removed all voids shall be filled with the surface mixture and left to harden as long as possible. After the concrete has set and become hard, the surface to be finished shall be dressed (with a bush hammer of 3 to 6 cuts per inch, a crandall, a toothed pick, a pneumatic or an electric, or other desired tool) to a uniform depth and finish. Care shall be taken to make all margins and patterns straight and true.

Typical Designs of Foundations for Piers, Abutments, Retaining Walls and Arches in Various Soils and Depths of Water (Not Including Pneumatic Foundations).

The committee has this year confined its work to obtaining designs of foundations of important structures. A circular letter was sent to the membership of the Association and a large number of answers were received,

including over 250 plans. From the plans received the committee has selected a number which are typical and represent designs in general use. The plans were reproduced with some explanatory notes and other information as a part of this report and were presented as information without recommendations.

Principles of Design of Plain and Reinforced Retaining Walls and Abutments

For several years the committee has collected information bearing on the practice of railroads and others on retaining wall design. A progress report was published in Vol. 10, Part 2, of the Proceedings, pp. 1317 to 1337. This report states that the use of a fixed ratio of width of base to height of wall is common practice and illustrates and discusses a number of actual walls, many of which have moved from their original positions. In this report the committee made no recommendations, feeling that further investigation should be made of the effect of earth pressures.

Since the publication of the above report, efforts have been made to secure additional information as to these pressures, but without success. Among others, a committee of the American Society of Civil Engineers is trying to get information along these lines, but finds that reliable data is very scarce. A member of that committee states that he thinks actual tests on an extensive scale will be required to produce any results of real value. This committee has been of the same opinion for a long time. No such tests have yet been made and in the absence of such definite information as they might be expected to produce and believing that the intelligent use of theoretical formulas leads to economical and proper design, this committee, therefore, recommends that Rankine's formulas, which consider that the filling is a granular mass of indefinite extent, without cohesion, be used in the designing of retaining walls. It is recommended that retaining walls be designed (*a*) for a level surcharge, or (*b*) for a sloping surcharge at the angle of repose, or (*c*) for a level surcharge with a uniform surcharge loading. Formulas based on Rankine are given for vertical walls, walls leaning away from the filling, and for walls leaning toward the filling.

The use of a fixed ratio of width to height leads to a neglect of the distribution of the pressure on the foundation. This is a question of great importance, since it is well established that movements from the original alinement, due to unequal settlement, from a defect more common than any other. The committee feels that attention should be called to the importance of making a study of each case in designing a wall, particularly of the weight and character of the filling, and the amount and distribution of the pressure on the bed of foundations.

Joint Committee on Standard Specifications for Cement

Almost from its beginning the cement industry in this country has sought the attainment of a single standard method of tests and specifications for cement.

The joint conference on Uniform Methods of Tests and Standard Specifications for Cement was created as the result of the following resolution by the Committee on Standard Specifications for Cement of the American Society for Testing Materials on March 7, 1912:

"In order to secure uniformity in the Specifications for Cement, it is recommended that the Board of Direction of the American Society of Civil Engineers, Committee on Standard Specifications for Cement, of the American Society for Testing Materials and the Government Departmental Committee on Specifications for Cement, be each requested to appoint a Committee of three to confer for the purpose of reconciling differences."

These committees met October 24, 1912, and organized under the title of "Joint Conference on Uniform Methods of Tests and Standard Specifications for Cement." The Conference presented its first report April 28, 1915, in which was included its recommended American Specifications and Methods of Tests for Portland Cement. These specifications were considered by the respective organizations of which the Conference was composed and the further modifications were considered by the Conference and its second report was presented June 1, 1916. After further consideration some additional modifications were made and the standard specifications and methods of tests were adopted by the American Society for Testing Materials by letter-ballot on September 1, 1916, with the understanding that they should become effective January 1, 1917.

These specifications were adopted by the U. S. Departmental Conference on December 7, 1916, and were reported to the Board of Direction of the American Society of Civil Engineers with a favorable recommendation by its special committee on January 6, 1917. The first and second reports of the Joint Conference will be available in a separate volume to be published by the American Society for Testing Materials and it is not necessary that they should be published by this Association.

Our committee recommends that this Association adopt these specifications and methods of tests for Portland Cement. The specifications for Natural Cement have not been considered, but it is expected that an agreement will be reached in regard to them during the year.

After 14 years' work the condition of chaos that prevailed in this country at the time the Committee on Uniform Methods of Tests of Cement was appointed by the American Society of Civil Engineers, has changed and there is now a single standard Specifications and Methods of Tests for Portland Cement. This committee feels that the adoption of a single standard Specifications for Portland Cement is a meritorious achievement whose effect will be far-reaching, since it will tend to standardize this product and result in a higher grade of material. (These specifications were published in abstract in the *Railway Age Gazette* of July 7, 1916, page 18.)

Joint Committee on Concrete and Reinforced Concrete

The Final Report of the Joint Committee on Concrete and Reinforced Concrete was adopted on July 1, 1916. The Masonry committee will subsequently submit for consideration and adoption by the Association such modifications of the Manual as may be necessary to bring it in accord with the recommendations of this report.

The Masonry committee feels that the work of the Joint Committee has been of inestimable value in standardizing the practice in the use of this important material of construction. Its recommendations have been widely used and form the basis of the regulations in the various municipal building codes, and in the specifications for plain and reinforced concrete in the Manual of this Association. No report on this important material can be considered final and this committee is in sympathy with the expressed views of the Joint Committee that the report should stand until sufficient progress has been made and experience gained that there are some subjects upon which experimentation is still in progress and the art of concrete and reinforced concrete will be advancing for many years to come.

Committee: F. L. Thompson (I. C.), chairman; J. J. Yates (C. R. R. of N. J.), vice-chairman; R. Armour

(C. T.), John C. Beye (C. R. I. & P.), G. E. Boyd (D. L. & W.), H. A. Cassil (B. & O.), T. L. Condron (Cons. Engr.), J. K. Conner (L. E. & W.), J. L. Harrington (Cons. Engr.), W. K. Hatt (Purdue Univ.), L. J. Hotchkiss, Richard L. Humphrey (Cons. Engr.), Noah Johnson (Wabash), M. S. Ketchum (Univ. of Col.), W. S. Lacher (*Railway Age Gazette*), C. P. Richardson (C. R. I. & P.), G. H. Scribner, Jr. (Contr. Engr.), F. P. Sisson (G. T.), J. E. Smith (Univ. of Ill.), Job Tuthill (P. M.).

Discussion

F. L. Thompson (chairman): Subject 1. The committee did not find anything in the manual that they cared to recommend for change at this time. "(a) Report on cost and method of constructing concrete piles, and make recommendations on how and where to be used. (b) Present additional typical designs for concrete piles for different loading and rules for driving under various conditions and loading." These specifications have been gone over again this year by the committee. The committee recommends the adoption of these and their insertion in the manual.

The President: The different articles of these specifications will be read and assumed to be approved as read unless there is objection raised.

H. S. Jacoby (Cornell U.): Before taking up the specifications in detail I would like to ask the committee whether they have considered carefully the nomenclature of the two classes of piles which are referred to in this report? I notice that they use the two terms, first, "pre-cast piles;" second, "cast-in-place piles." Several years ago I had occasion to go through engineering literature thoroughly and made a tabulation of the different terms employed, and finally came to the conclusion that pre-molded would be a better term than pre-cast.

C. E. Lindsay (N. Y. C.): Is it the intention of the committee that these definitions be adopted by the association, pre-molded concrete piles and cast-in-place piles? Are those offered as definitions?

Mr. Thompson: I would suggest that the definition conform to: "(a) Pre-molded concrete piles—piles which are molded previous to driving. (b) Cast-in-place concrete piles—piles which are cast in holes previously formed in the ground."

W. M. Camp (Railway Review): It seems to me if you want to be concise, you can curtail the second definition. The word "previously" is not necessary, and neither is "form."

The President: How would you suggest it read?

Mr. Camp: "Piles which are cast in holes in the ground."

Mr. Thompson: The committee will accept that.

(Adopted.)

Mr. Thompson: Specification for constructing concrete piles. "The piles shall be made in accordance with the dimensions shown on the drawings."

(Mr. Thompson then read the first paragraph.)

Mr. Lindsay: Would it not be better to say the workmanship and material shall be in accordance with A. R. E. A., and so forth?

Mr. Thompson: That is satisfactory.

(Mr. Thompson then read the second, third, fourth and fifth paragraphs.)

Mr. Jacoby: Has the committee considered the question of artificial seasoning, by which the time may be properly reduced?

Mr. Thompson: Yes, sir; that was considered to a certain extent, but we did not feel justified in making the time shorter than 28 days. I move the adoption of these specifications for constructing concrete piles.

R. H. Ford (C. R. I. & P.): I think before that section is adopted, perhaps a little more consideration should be given to the suggestion of Prof. Jacoby.

I move that it be referred back to the committee for further study.

(Motion seconded.)

(On vote, the amendment was lost.)

The President: The question is on the original motion to adopt these specifications for printing in the manual. (The motion carried.)

(Mr. Thompson then proceeded with the matter headed "Specifications for driving concrete piles.")

(In connection with the paragraph "For a load of fifteen tons.")

H. R. Safford (G. Tr.): Is that clause restricted to a manufactured article which precludes competition?

Mr. Thompson: No, sir. The clause says "Or other hammer of like mechanical effect."

Mr. Lindsay: I think it would be unfortunate if we established any one particular make as a basis of comparison. Can the committee give a general description of the hammer, without any particular reference to its name?

Mr. Thompson: Yes, we can do that. We will also make the change in the next paragraph.

B. R. Leffler (N. Y. C.): The committee says "or other hammer of like mechanical effect." I suppose they have reference to the foot pounds work done by the drop of this hammer?

Mr. Thompson: That is correct.

Mr. Leffler: I would call attention to the fact that there are steam hammers now in use which may exert a pressure of 900 or a thousand pounds, but they have back of them a steam pressure push, which makes the hammer just as effective as the Vulcan hammer or hammers of similar type. I suppose this paragraph would include such a type of hammer.

Mr. Thompson: This paragraph is intended to cover that very feature. We have in use two or three hammers similar to those Mr. Leffler has spoken of.

J. G. Sullivan (Can. Nor.): I was going to call attention to the same point the previous speaker did, but there is one other feature of this clause where I can see the chance for some trouble. The committee has presupposed that the testing has been properly done. In case it has not been properly done and some of the piling should blow down, you might get into trouble with the contractor who would claim that he had fulfilled his obligations, if I read the specification aright.

Mr. Thompson: The committee will accept the suggestion of Mr. Sullivan with regard to the rearrangement of the clause.

(Mr. Thompson then read the paragraph headed, "Cutting Off Piles.")

Mr. Thompson: I move that these specifications, as modified, for driving concrete piles, be adopted and inserted in the manual.

(The motion was carried.)

Mr. Thompson: The matter referring to cast-in-place and pre-molded piles is submitted as information.

Prof. Jacoby: Regarding the first item under cast-in-place piles, it seems to me it is much more advisable to state the advantages of cast-in-place piles over pre-molded piles, though at the same time stating the advantages of pre-molded piles.

I believe that the approximate depth should be determined in advance. No one thing will usually lead to more economy in design and construction than a preliminary exploration of the site in order to determine

what the conditions are. That was emphasized to some extent in the principles of pile driving, but I think this portion of the report assumes that there is a certain advantage in one type over the other. Statement No. 2 is practically covered by the same remarks. Statement No. 4, as it is phrased, seems to imply that the cast-in-place piles do not need to be seasoned before the load is applied.

Referring to No. 5, it should be remembered that only a small percentage of piles need to be treated to determine the bearing power of a large group of piles. The statement as printed seems to imply that every pile needs to be tested. With reference to the paragraph reading, "Loading of piles may be calculated from the same formula as that given for pre-cast piles, but as above stated, this can be more accurately determined in the 'cast-in-place' piles," I do not believe that statement synchronizes with the truth.

There is one subject of great importance which is not alluded to at all. It is this: What measures have to be specified in order to prevent serious injury to cast-in-place piles by driving others near them before the first ones have properly settled? That is a matter which has been taken up by some railroads and they have made experiments on the matter and have determined that such specifications are of great importance.

It seems to me that even though this is only given as information, it really ought to be put in better form before it is finally placed in the proceedings, for the guidance of those members who may desire information on the subject.

Mr. Thompson: I wish to thank Professor Jacoby for his comments. This matter will be given consideration the coming year by the committee.

The President: The chair desires to call attention to the inconsistency in the adoption of the specifications for driving concrete piles, which has been done, in that in those specifications reference is made to the drawings and certain clauses in these specifications are dependent, for a proper understanding and construction of them, upon these drawings, which have not been made a part of this report. They were submitted last year as information, and it is the judgment of the chair that it would be wiser if these specifications should be withdrawn and that they should be submitted again in connection with the plans. This is offered as a suggestion, and if anyone desires to carry it out it can be taken care of by a motion to reconsider. If not, the specifications will be printed in the manual.

R. H. Ford: I think that point is well taken, and as I was one of the men who voted for this motion, I would move a reconsideration, so that we may follow the proceedure suggested, namely, that it be referred back and reported with drawings next year.

(The motion was carried.)

R. H. Ford: I ask to have further consideration given to the specifications during the next year on the lines I have outlined.

Mr. Thompson: I ask Mr. Ford to submit his suggestions in writing to the committee.

Mr. Ford: I will do that.

John G. Sullivan (Can. Pac.): There are one or two points mentioned here which I think should be corrected. They speak of piles setting in concrete as drying. Is it not the opposite? Is it not dehydration that takes place? Prof. Jacoby, I think it was, said that piles dry quicker outside the ground than in the ground. I question that, and I am inclined to think that the opposite is the fact.

Mr. Thompson: I move that the "Specifications for surface finishes of concrete" be adopted.

The President: The chairman of the committee will read the heading of each article, and that article will be considered adopted unless there is objection.

Mr. Lindsay: In paragraph 2 under "General," the first sentence says "shall be," and the next clause says "where a continuous operation is not possible." I suggest that the "shall be" be changed to "should be."

L. N. Edwards (Dept. of Work, Toronto): In reference to Section IV, there is one question I would like to ask. The last section of it says: "When the desired finish is obtained the whole surface shall be thoroughly washed with water. That is not absolutely necessary. In fact, I have seen very large concrete work where it was not necessary. The rubbing was done with floats and the concrete was left in its floated condition and allowed to set in that condition. A sort of shell-like appearance would be brought about by moving the float with a circular motion. It seems to me that this washing off with water removes a great deal of surface cement. I have no doubt that it does that. It leaves the surface in a condition for future disintegration through water entering it, producing falling off.

Mr. Thompson: Unless it is washed, you are likely to have more of the scale fall off than otherwise.

E. A. Frink (S. A. L.): Referring to the note at the end of Section VIII, we have built a good deal of reinforced concrete, and we find unless the forms are removed as quickly as possible even neat hydrochloric acid will not produce a sufficient effect to wash the sand and mortar off to a sufficient extent to show the aggregate. The idea of making the finish is to produce a better surface by exposing parts of the aggregate. I suggest that a further paragraph be added in this section reading:

"For successful treatment forms should be removed as soon as possible after the concrete is cast."

Mr. Thompson: The committee thought they had covered that point about taking the forms off in the fourth line of the first paragraph where it says, "The strength of the solution shall be determined by trial on the work and shall only be such that the bond of the cement will be readily broken to the required depth." The strength of the solution would take care of that whether you take the forms off in two days or a week. I understand the point Mr. Frink makes is that the sooner you take the forms off the easier it is to get action by the acid.

Mr. Frink: I realize the committee covered that in the specification, but according to our experience that is not sufficient, because the neat hydrochloric acid would not cut the cement after it was hard set. It was absolutely impossible to produce the effect we wanted unless we swept the forms as soon as the concrete set.

Richard L. Humphrey (Cons. Eng.): I had experience with a case of treating the surface more than six months old, where the cement had dried in the summer time and had a very hard set. It takes more acid, but that is the only difference. The greener the surface is the more dilute the solution can be in order to get the effect.

The President: Mr. Frink, do you offer that as an amendment?

Mr. Frink: Yes. I appreciate the point Mr. Humphrey just made. In that case it worked, but I know of a case when it did not work; whether or not the acid was commercially pure I do not know, but a repeated application of supposedly pure hydrochloric acid would not produce the effect. It is possible this method of producing the effect would not work, and therefore I think this new clause should be added.

(The motion made by Mr. Frink was put to a rising vote, and was lost.)

B. R. Leffler (N. Y. C.): Regarding Item X, Tooled finish, I notice in "sand-blast finish" a period of time of 10 to 14 days is specified. For tooled finish we should have an equally good specification. I do not think we should brush-hammer a surface two or three days old. In fact, I think we should have a harder surface on which to brush-hammer or tool-finish than any other kind of surface.

Mr. Thompson: The committee will accept that.

The President: The motion is before you for the adoption of these "Specifications for Surface Finishes of Concrete."

(The motion carried.)

Mr. Thompson: I move that the designs for retaining walls and formulas for designs of retaining walls be inserted in the manual.

(The motion carried.)

Mr. Thompson: I move that the association adopt the specifications and methods of test for Portland cement.

F. E. Schall (L. V.): If these specifications have been adopted by the American Society for Testing Materials and the joint committee, they should be adopted as printed. These specifications represent the labor of many years and it has not always been a smooth path. I second the motion for their adoption.

C. E. Lindsay: On behalf of the manual, I assume these specifications will take the place of those in the manual which are headed, "Specifications for Natural and Portland Cement," whereas the new specifications only apply to Portland cement.

Mr. Thompson: These specifications are intended to take the place of those which now appear in the manual and the committee will have something to say in a few minutes in regard to the natural cement specifications.

(The President put the question on the adoption of the specifications for Portland cement, and it was carried.)

Mr. Thompson: The adoption of these joint specifications in the place of those in the manual leaves the specifications for natural cement in such shape that they cannot be used, and the committee has revised the specifications for natural cement as they appear in the manual by changing the form and phraseology to make them conform to the general specification for Portland cement. The committee recommends the substitution of those specifications for those which appear in the manual at present. We call attention to the fact that the specific gravity was left out in error.

Mr. Humphrey: The specification as to natural cement has not been revised as to its substance. The requirements are the same. But, as the chairman stated, when you take out the Portland cement specification the old specification for natural cement is mutilated and not in usable form, and to make the specification usable the committee has simply rearranged it as to phraseology, but has not changed the requirements. The specific gravity requirement should be there, just as it appears in the manual.

The President: It is understood that these specifications for natural cement do not change the substance of the specification now in the manual relating to natural cement, but the changes are simply made so as to make this specification conform to the specification for Portland cement which has been adopted. With this understanding, the motion is before you for the adoption of specifications for natural cement. Is there any discussion?

C. W. Baldridge (A. T. & S. F.): I want to ask a question in regard to the contents of a barrel of cement, as shown in Section 6. Is it customary that three sacks of cement constitute a barrel in the natural cement and four sacks constitute a barrel in the case of Portland cement?

Mr. Humphrey: That is the customary practice.

(The specifications were then adopted.)

The President: The committee is dismissed with the thanks of the Association.

Report on the Grading of Lumber

THE committee last year presented tentative specifications for Southern Yellow Pine Bridge and Trestle Timbers to be Treated. Careful consideration has been given this specification during the year. The committees on Wooden Bridges and Trestles and Wood Preservation were communicated with and asked for their recommendations. The committee on Wood Preservation endorsed the specifications. The chairman of the committee on Wooden Bridges and Trestles advised that the matter was considered at one of their committee meetings and the proposed specifications were discussed at length. The result of this discussion was: "Committee VII is not prepared to approve paragraph No. 4, for the reason that we do not think that dense pine is suitable for creosoting." The committee, in other words, neither approves nor disapproves paragraph No. 4 because of the feeling which they had that dense pine was not suitable for creosoting purposes. Our committee has investigated this phase very thoroughly and believes that their recommendation should be sustained. We accordingly recommend the specifications proposed last year for adoption, with certain slight changes, and submit them for adoption and publication in the manual.

Dr. Hermann von Schrenk, Chairman

In co-operation with the committee of the American Society for Testing Materials, this committee during the past year has given consideration to the desirability of formulating a density rule for Douglas fir, similar to that adopted last year for yellow pine. The rule has been worked out during the past year in co-operation with the American Society for Testing Materials and the West Coast Lumbermen's Association, which we submit as information.

Proposed Specifications for Southern Yellow Pine Bridge and Trestle Timbers to Be Treated

(To Be Applied to Single Sticks and Not to Composite Members)

1. General Requirements. Except as noted, all timbers shall be sawed to standard size, full length, square cornered and

straight; close grained and free from defects such as injurious ring shakes and cross grain, unsound or loose knots, knots in groups, decay or other defects that will materially impair its strength.

2. STANDARD SIZE. "Rough timbers sawed to standard size" means that they shall not be over ¼ in. scant from the actual size specified. For instance, a 12 in. by 12 in. timber shall measure not less than 11¾ in. by 11¾ in.

3. STANDARD DRESSING. "Standard dressing" means that not more than ¼ in. shall be allowed for dressing each surface. For instance, a 12 in. by 12 in. timber, after being dressed on four sides, shall measure not less than 11½ in. by 11½ in.

4. QUALITY. All timbers shall be dense pine as defined by the American Railway Engineering Association's rule for dense pine.

5. STRINGERS. Knots greater than 1½ in. in diameter will not be permitted in any section within 4 in. of the edge of the piece, but knots shall in no case exceed 4 in. in their largest diameter. There shall be no restrictions as to the amount of sapwood allowed.

6. CAPS AND SILLS. Shall be free from knots over 2½ in. in diameter. There shall be no restrictions as to the amount of sapwood allowed.

7. POSTS. Shall be free from knots over 2½ in. in diameter. There shall be no restrictions as to the amount of sapwood allowed.

8. LONGITUDINAL STRUTS AND GIRTS. Shall be square cornered and sound and shall be free from large knots or other defects that will materially injure their strength. There shall be no restrictions as to the amount of sapwood allowed.

9. LONGITUDINAL X-BRACES, SASH AND SWAY BRACES. Shall be square cornered and sound and shall be free from any large knots or other defects that will materially injure their strength. There shall be no restrictions as to the amount of sapwood allowed.

10. TIES AND GUARD TIMBERS. Shall be free from any large knots or other defects that will materially injure their strength. There shall be no restrictions as to the amount of sapwood allowed.

STRUCTURAL DOUGLAS FIR SPECIFICATIONS FOR BRIDGE AND TRESTLE TIMBERS

1. DEFINITIONS. The following definitions are used in connection with this grading rule:

(a) ANNUAL RING.—Each annual ring is composed of two distinct types of wood structure, *i. e.*, the porous, light-colored and lightweight springwood formed during the first part of the growing season and the hard, dense and darker-colored summerwood formed during the latter part of the growing season.

(b) SUMMERWOOD.—Summerwood is the hard, dense portion of the annual ring. It is darker in color than the more porous springwood.

(c) SOUND AND TIGHT KNOT.—A sound and tight knot is one which is solid across its face and which is as hard as the wood surrounding it; and is so fixed by growth or position that it will retain its place in the piece.

(d) ENCASED KNOT.—An encased knot is one whose growth rings are not intergrown and homogeneous with the growth rings of the piece in which it occurs. The encasement may be partial or complete; if intergrown partially or so fixed by growth or position that it will retain its place in the piece, it shall be considered a sound and tight knot.

(e) LOOSE KNOT.—A loose knot is one not firmly held in place by growth or position.

(f) ROTTEN KNOT.—A rotten knot is one not as hard as the wood surrounding it.

(g) MEASUREMENT OF KNOTS.

In beams, the diameter of a knot on the narrow or horizontal face shall be taken as its projection on a line perpendicular to the edge of the timber. On the wide or vertical face, the smallest dimension of a knot is to be taken as its diameter.

In columns, the diameter of a knot on any face shall be taken as its projection on a line perpendicular to the edge of the timber.

(h) DIAGONAL GRAIN.—(Including cross and spiral grain.) Diagonal grain is grain not parallel with all the edges of the piece.

(i) DENSE AND SOUND DOUGLAS FIR.—Under this heading two classes of timber are designated. (1) Dense Douglas fir and (2) Sound Douglas fir. It is understood that these two terms are descriptive of the quality of the clear wood.

(j) DENSE DOUGLAS FIR.—Shall show on either one end or the other an average of at least 6 annual rings per inch, or 18 rings in 3 in., and at least 33⅓ per cent summerwood, as measured over the third, fourth and fifth inches on a radial line from the pith, for girders not exceeding 20 in. in height, and for columns, 16 in. square or less. For larger timbers the inspection shall be made over the central 3 in. on the longest radial line from the pith to the corner of the piece. Wide-ringed material excluded by the above will be accepted, provided the amount of summerwood as above measured shall be at least 50 per cent.

In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3 in. on an approximate radial line, beginning at the edge nearest the pith.

The radial line chosen shall be representative. In case of disagreement between purchaser and seller as to what is a representative radial line, the average summerwood and number of rings shall be the average of the two radial lines chosen.

(k) SOUND DOUGLAS FIR.—Shall include pieces of Douglas fir without any ring or summerwood requirement.

Select Structural Grade

2. GENERAL REQUIREMENTS. (a) Shall contain only Dense Douglas fir timbers as defined in paragraph (j). (b) Shall consist of lumber well manufactured, square edge and sawed standard size; solid and free from defects, such as ring-shakes and injurious diagonal grain; loose or rotten knots; knots in groups; decay; pith pockets over 6 in. long or ⅜ in. wide, or other defects that will materially impair its strength. (c) Occasional variation in sawing not to exceed ¼ in. scant at time of manufacture allowed. (d) When timbers 4 by 4 in. and larger are ordered sized, they will be ½ in. less than rough size, either S1S1E or S4S, unless otherwise specified.

STRINGERS, GIRDERS AND DEEP JOISTS. Shall show not less than 85 per cent of heart on each of the four sides, measured across the sides anywhere in the length of the piece. Shall not have in volumes 1 and 2 knots greater in diameter than one-fourth the width of the face in which they occur, with a maximum of 1½ in. in diameter. Shall not have in volume 3 knots larger than one-third the width of the face in which they occur, with a maximum of 3 in. in diameter. Knots within the center half of the span shall not exceed in the aggregate the width of the face in which they occur. Shall not permit diagonal grain in volumes 1 or 2 with a slope greater than 1 in 20. When stringers are of two-span length, they shall be considered as two separate pieces and the above restrictions applied to each half. The inspector shall place his stamp on the edge of the stringer to be placed up in service.

CAPS AND SILLS. Shall show 85 per cent of heart on each of the four sides, measured across the sides anywhere in the length of the piece, and shall be free from knots larger than one-fourth the width of the face in which they occur, with a maximum of 3 in. in diameter. Knots shall not be in groups.

POSTS. Shall show not less than 85 per cent of heart on each of the four sides, measured across the face anywhere in the length of the piece, and shall be free from knots larger than one-fourth the width of the face in which they occur, with a maximum of 3 in. in diameter. Knots shall not be in groups.

LONGITUDINAL STRUTS OR GIRTS. Shall show all heart on one face; the other face and two sides shall show not less than 85 per cent of heart, measured across the face or side anywhere in the length of the piece. Shall be free from knots over 2 in. in diameter.

LONGITUDINAL X-BRACES, SASH BRACES AND SWAY BRACES. Shall show not less than 85 per cent of heart on two faces and shall be free from knots larger than one-third the width of the face in which they occur, with a maximum of 2 in. in diameter.

BRANDING. The inspector shall brand each timber which conforms to the above requirements, "Selected Structural Douglas Fir."

CLASSIFICATION OF USES OF LUMBER

The principal subject assigned to the committee by the Board of Direction was to "draw up in unified form a set of specifications for construction timbers and building lumber for use on railways, showing each kind of quality of lumber or timber which is suitable for each of the different classes of work on a railway." The idea underlying these instructions undoubtedly was interpreted by the committee to mean that we should prepare a set of standards in which the use of the timber or lumber was to be co-related with the various grades which had hitherto been adopted as standard. The committee found itself confronted with the problem which, early in the year, it was recognized would require a good many years of close and careful study and interchange of opinion. Believing that the subject is of suffi-

cient importance to receive the serious consideration of all members of the Association, the committee has confined its work this year to establishing a broad and general classification as to uses, which is herewith submitted as a progress report. It was thought desirable that, before attempting any further co-relation between uses and the grades, the broader aspects of the problem be first determined upon. The committee accordingly asks for criticism of this classification and for a vote as to the desirability of continuing along the lines laid out.

PROPOSED PLAN.—It is proposed to classify the uses of lumber on a railroad into four large groups, these to include the general subjects indicated under each heading.

(I) **Bridge and Construction Timber**
To include:
Combination and Howe Truss Spans.
Span Bridges.
Frame Trestles.
Piles.
Falsework.
Concrete Forms.
Tank Supports.
Docks and Wharves.

(II) **Frame Buildings**
To include:
Station Buildings.
Engine Houses.
Machine Shops.
Section Houses.
Miscellaneous Small Buildings.
Warehouses.

(III) **Ties**
Ties.
Switch Ties.

(IV) **Miscellaneous Roadway Material**
To include:
Crossing Plank.
Platforms.
Stock-Guards.
Signs and Posts.
Fence Posts.
Culverts and Drains.
Stock Pens.
Poles.
Cross-Arms.
Conduits, etc., etc.

In addition to preparing this outline, the committee has done a good deal of work with reference to the special division of the individual classes and lumber grades pertaining thereto, but we do not feel prepared to submit these this year, especially as much of this work would have to be done over in case the general plan proposed does not meet with the Association's approval. In case the outline is approved, appropriate work for the next year's committee would consist in tabulating the various uses and asking for a detailed expression of opinion from the various members as to their present practice.

It is accordingly suggested that the work of the committee next year include:

1. Further consideration of the proposed rules for Douglas fir timbers.

2. Continuing to elaborate on the classification of lumber as related to its use. (It is believed that this is the most important problem now being discussed as "wood uses.")

Committee: Dr. Hermann von Schrenk (Cons. Engr), chairman; B. A. Wood (M. & O.), vice-chairman; F. C. Baluss (D. M. & N.), W. McC. Bond (W. & Va.), D. Fairchild (N. P.), W. H. Gardner Jr. (G. & S I.), G. A. Mitchell (G. T.), W. H. Norris (Me. C.), J. Taylor (K. C. S.), S. L. Wonson (M. P.).

Discussion

Dr. Herman von Schrenk (chairman): Last year your committee presented some proposed specifications for Southern yellow pine bridge and trestle timbers to be treated. These have been held over for the year and certain slight changes as to verbiage and paragraphing were received, all of which the committee has given due attention and has made the necessary changes and makes recommendation this year that these be adopted as standard.

Some criticism has been received by the committee, directed particularly against the section on quality, in which the committee has specified that all timber shall be dense pine. We wish to call attention to the fact that the specification as written was practically copied from the manual rules of the association, with the exception that we have omitted all reference to sap wood for timbers to be treated. The committee had under consideration the desirability of putting in a second grade which would include the use of loblolly or short-leaf pine, which is used on a great many of the railroads, but we believe before doing so we should have the dense or first grade adopted, first of all. I move that the proposed specifications as presented by the committee be voted on.

The President: The chair will ask Dr. von Schrenk to read each one of the items in this specification, and each item will be accepted as being approved, unless there is argument against it, under which circumstances it will be open for discussion and disposition.

(Dr. von Schrenk read the paragraphs of the specification.)

C. E. Lindsay (N. Y. C.): I think the latter clause of par. 2 might be omitted in the specification, but inserted in the manual. The first part of the clause is sufficiently descriptive.

Dr. von Schrenk: The only reason we presented that was to maintain absolute conformity with the rule as it now is in the manual, and this makes no change.

The President: Would you be willing to accept the suggestion that the last sentence be omitted in par. 2?

Dr. von Schrenk: Yes, we accept that.

Mr. Lindsay: I make the same suggestion regarding paragraph 3.

Dr. von Schrenk: We accept that.

E. A. Frink (S. A. L.): Before that clause is acted on, I have a few words I would like to say to the association. I do not think that this clause ought to be included in our specification. The basic purpose of the treatment of timber is for its preservation. Unless we can get a treatment that will surely give us a sufficient increased length of life in the timber to more than compensate for the additional expense, it does not seem to me that we want to adopt this. In order to make sure of getting that we must have the best treatment we can get, even though a less good treatment would give us a profitable length of life. It seems to me in order to get that best treatment we should use the timber best adapted to that treatment, whatever it may be. (Mr. Frink then read a large number of letters from the officers of railways, lumber companies and creosoting plants that expressed a wide diversity of opinions on this subject.

Mr. Frink: The principal objection from a number of roads, and I believe on the part of the committee on grading of lumber to the use of loblolly short-leaf pine is because of its alleged weakness. Loblolly pine or short-leaf pine is not as strong as southern pine. Our manual contains the requirements that the allowable fiber stress on dense pine is 3,300 lb. to the square inch. The difference in the other allowable stresses, such as present shearing strength parallel to and across the grain, is little more marked. Whether or not it is more marked, or whatever the difference in the allowable stress is does not seem to me to enter into the question. No construction material is perfect. In our construction work we have to use the material that we can get, subject to disabilities and disadvantages. If ideal construction material could be obtained it would possibly be a material that is equally adapted to all kinds of construction, not only from the standpoint of durability, from

points of cheapness, but from the point of strength. That material is nothing more than a dream at present. So we have to use the materials as we find them. Perhaps a nearer approximation to that is concrete. Concrete has in recent years grown strongly in favor and has been used for innumerable structures. I think you will all agree with me that the greatest drawback in concrete is its weakness, not only weakness in shearing and tension, but weakness in compression. We supplement that weakness, and add strength by steel reinforcement. In compression we usually don't add anything to it. Now we have got to cure that weakness in some way. The way we cure that weakness is simply by adding more material. Now, the comparative strength of steel and concrete in compression, roughly expressed, is 1 to 32. In other words, steel is about 32 times stronger than concrete in compression. Nevertheless, we use concrete continually and with perfect safety and satisfaction in compression, in our beams, in our arches, in our floor-slabs, even beams and arches carrying the heaviest railroad traffic in the country, without any safeguards for our trains except the inherent strength of the concrete itself. It seems to me that is a close parallel to loblolly pine. Admitting for the sake of argument that loblolly pine is somewhat weaker than heart pine, dense pine, what is to prevent us adding something, if by doing so we can get greater strength and economy in the building of our structures? Why is that not the proper course?

The Seaboard Air Line at the present time has something over four miles of creosoted ballast deck trestles. They are all built, without exception, of loblolly pine. Something over a mile of those trestles was completed in 1910 and has been used ever since. Those trestles were built of five piles to the bent, 12½ ft. bents, and 6 in. by 12 in. loblolly pine stringers packed solid, the caps being 12 in. by 12 in. loblolly. At the present time they are carrying Mikado engines of 52,300 lb. on axle, 282,000 lb. engine only. Also, mountain type engines with 52,900 lb. on axle, 316,000 lb. engine only. I want to remind you, I read a little while ago a letter from a southwestern road which had to take out 75 caps of similar material. I have no information as to the details of their trestles. I don't know the size of the caps, the number of the piles or the size of the spacing. Therefore, I can't express an opinion as to why those caps failed, but I do know that our ballast deck trestles have been in service seven years, and we have yet to find the first sign of failure of any kind in any timber, any cap in any part of the trestle. They were reported on in January, and the report of our general bridge inspector is to the effect that not a fiber shows any sign of deterioration. The reliance of the Committee on Grading of Lumber in their specifications for the durability of timbers seems to be in the forming of a creosoted envelope around the stick. It seems to me that there is considerable doubt whether that creosoted envelope will be effective.

The President: In permitting the reading of articles and their adoption, without formal vote, the chair is assuming that a proper motion has been made and seconded, and that the article has been voted upon. It therefore becomes necessary, when discussion arises, that the motion must be considered to have been made and seconded.

Mr. Frink: I have an amendment. I don't believe, in rejecting that clause altogether. I have no objection to treating dense pine, when another company wants to use dense pine and desires to treat it. The objection I have made to that clause is its exclusiveness. It forbids the use of anything but dense pine. I move the clause be referred back to the committee for further action, and that they bring in specifications for various kinds of wood suitable for treatment. (Motion seconded.)

The President: The article is now open for discussion.

E. H. Bowser (I. C.): Mr. Frink has covered the ground so thoroughly, I have very little to say. It happens that I know something of the experience of the L. & N. Railroad in this matter. From the letters read it looks as though Mr. Courtenay was taking the lasting quality of long-leaf timber on trestles. We know on the L. & N. some heart pine was treated probably 42 years ago, which is still in use, but it was given very long steaming and very long vacuum. I had charge of their work some time ago, and as far as I could find in their records nothing was ever steamed less than 15 hours; most of it was steamed 18 hours, and the regulation of vacuum was six hours, with the steam pipes going on during that period. I don't believe there is a works in the country that does anything like that to-day. Their steaming was 35 pounds, and very little less than 35 pounds in the old days. They, of course, treated timber that was kept in water storage largely. I have seen timber that was treated as much as two and three inches, close to the ground, yellow pine. There is no question the outer fiber of the timber was hurt, but as some has lasted 42 years I don't think that speaks very badly for it.

Hans Ibsen (M. C.): I thoroughly agree with Mr. Frink in what he says. I can't see any use in using dense pine creosoted timbers. There might be some excuse for using dense pine for stringers and perhaps caps, although as far as I am concerned I can't see it. We use dense pine for our stringers, for untreated timber. If we use the southern pine or the loblolly pine, and we are sure that it is well preserved and will maintain its strength throughout its life, I think we can use that safely where we would have used untreated pine in stringers. In caps I can't see that we would get any benefit out of using dense pine.

Dr. von Schrenk: I would like to say a few words as to the points that have been brought up against the specification. I am pleased to note that these specifications deal strictly with bridge and trestle timbers, stringers and sills. They have nothing to do with piling and have nothing to do with treating timber against teredo or anything except the natural forces of decay that take place on land. The committee admits that the heartwood or dense pine cannot be penetrated as easily as sap, but at the same time we emphasize the fact that that is not necessary. If you get skin penetration in a dense pine or heartwood, it will last as long as 2 in. or 3 in. penetration in sapwood. Our sole justification in presenting this specification was to have first of all the highest standard the association could use. We admit the practicability and desirability of using loblolly or short-leaf yellow pine creosoted. The committee will be glad indeed to accept the suggestion to bring in a second specification if the Committee on Bridges will indicate to us what the relative difference in stresses allowable between the high-grade type of structure and the secondary type of structure is in which we would be warranted in using yellow pine.

Mr. Frink: This specification, as it appears on its face, is a specification of southern yellow pine bridge and structural timbers to be treated. That includes all the timbers that are to be used for trestle building. The reason our manual at present specifies stringers and so forth shall be the best grade of long-leaf pine is because we recognize the fact that loblolly pine is not durable. It is not because it has not strength, but simply because it is not durable; therefore, I don't think that reason for using the same dense pine specification for treated timber is a good one. As to the adoption of this clause, with the change of caption and a change indicating it is

only for dense pine, that literally seems without objection, but it does seem to me objectionable for this reason: That if we put such a specification in our manual and have no specification for any other timber to be treated, it looks as though we look with disapproval on the use of any other timber. I would object to this report even with the changed heading, on that ground.

Mr. Lindsay: I do not find the density rule in the manual. I believe it was adopted at the last convention, but whether it was to be inserted in the manual, I do not recall. It seems to me this specification should contain the density rule and not merely refer to it. I wonder if Mr. Frink would consent to a further consideration of this being laid on the table until we continue the study of the other items of the specification and then take this up?

Mr. Frink: That is entirely satisfactory to me.

The President: Under the suggestion by Mr. Lindsay, the chairman of this committee agrees to accept back these proposed specifications for further consideration and report next year.

Dr. von Schrenk: The committee will be glad to go over this matter again, but in view of the fact that this is a committee on grading of lumber, the committee naturally would refuse to accept responsibility on a relative classification for two specifications, and we would specifically request authority from the convention to have the Committee on Bridges, to which this properly belongs, enunciate what grades they would like to have established, so that there may be a clear understanding of what we would call, first, a first-class bridge, with certain stresses allowable, which would permit dense pine. We would respectfully request the convention to enunciate something more definite than there is in the manual at the present time as to basis on which that classification should be established.

The President: This report is referred back to the committee for further investigation and report next year. It is the function of the board to arrange for co-operation between this committee and the Committee on Wooden Bridges and Trestles, as requested by Dr. von Schrenk.

The committee is dismissed with the thanks of the association.

Report of Committee on Wood Preservation

Earl Stimson, Chairman

IN co-operation with the committees of the American Society for Testing Materials and the American Wood Preservers' Association, our committee has revised the adopted Specifications for Fractionation of Creosote Oil. No radical change has been made from the specifications as printed in the Manual, but they have been made more precise and explicit. A number of new features have been added, the need for which has become increasingly apparent with the use of the present specifications. The revised specifications have been very carefully tried out, and have been adopted by the American Wood Preservers' Association as standard. They will be presented for adoption by the American Society for Testing Materials at their coming meeting in June. It is desirable that a uniformity exist in the specifications of the two named associations and of this Association, the more so as the membership of our committee and those of the committees reporting on this subject to the other two associations are closely interlocked. The committee, therefore, recommended that these specifications be adopted to replace those printed in the 1915 Manual.

Water Sampling in Creosote Oil

During the past year the committee has continued investigations for the purpose of developing a standard apparatus for sampling creosote oil in tank cars and storage tanks, in order to obtain accurate samples for water determinations. Using the data obtained last year and reported upon by the committee in 1916, an apparatus was finally constructed which shows every indication of overcoming many of the difficulties hitherto experienced. This apparatus consists of a brass cylinder with a pointed, perforated bottom. The holes in the bottom are closed by means of a spring valve, which can be opened by means of a wire extending along the extended stem attached to the cylinder. This stem is made in several sections, so that it can be used at any depth. The stem is calibrated in feet and inches, thus facilitating the zone sampling.

As a result of the investigations made, the committee recommends that the following clause be adopted by the Association for insertion in the manual:

It is recommended as good practice that, in order to obtain accurate determinations as to the percentage of water contained in creosote oil in tank cars and in storage tanks, the principle of zone sampling be employed, as described in the 1916 report of this committee, and that for the purpose of obtaining zone samples an apparatus of the type illustrated in this report be used.

Exposure Tests of Ties Treated with Water-Gas Tar

The committee has been endeavoring for several years to locate some authentic use of water-gas tar oil, and until this year it has only been able to advise of its extended use, though in some cases it was being used under the name of coal-tar creosote, or as an addition to coal-tar creosote. This year we have been able to locate a company, the Public Service Company of New Jersey, which has been using straight water-gas tar oil in treating a majority of its ties, beginning in 1911. For the first year its ties were treated by a commercial plant, but since that date some of them have been treated at the plant of the United Gas Improvement Company, Philadelphia, Pa.

With the co-operation of the Public Service Company and the United Gas Improvement Company we have been able to learn the grade of oil used during all of this work. They advise that the oils in 1911, 1912, 1913 and 1914 were straight water-gas tar distillates.

The ties treated in 1911 were seasoned by preliminary steam seasoning. Those treated in the other years were either air- or steam-seasoned, depending upon the preliminary air-seasoning, the majority of them being steam-seasoned. Each tie has a dating nail showing the year of treatment.

The treatment received by all these ties was a full-cell treatment of ten pounds per cubic foot. Those treated in 1911 at the commercial plant were rigidly inspected, and it is certain that they were well treated. Those treated

in the latter years were treated under the supervision of the chemical department of the United Gas Improvement Company, and their records show that the ties received the full amount of oil specified.

While it is too soon to draw any definite conclusions from the treatment of these ties, up to date not a single tie has been removed, and from the inspection made late in November, 1916, none of them shows any signs of deterioration.

Record of Service Tests

Under this subject heading appeared a history of service tests of cross-ties on the Great Northern, including tamarack, pine, spruce, fir and cedar ties, both untreated and Burnettized, many of which have been conducted since 1903.

In the spring of 1911 various kinds and types of ties, including untreated, Burnettized and creosoted ties, were placed out of face from Belt, Mont., to Gerber, Mont., on the Butte division. On the date of the last inspection, October 6, 1916, when the ties had been in service five years and four months, practically no removals had been made excepting the creosoted fir ties, which were splitting because of the lack of air-seasoning prior to treatment as well as excessive steaming in order to insure the 12 lb. per cu. ft. absorption of creosote oil. That part of the test must, therefore, be abandoned, as it is not representative of what might be expected of properly creosoted fir ties.

A report was also presented of the service obtained from treated ties on the Chicago & Eastern Illinois. The ties are principally of red and black oak, and were treated by the Wellhouse, Burnett and Lowry processes. The oldest records extend over 15 years' service.

A report on service tests of cross-ties was presented which was compiled by P. R. Hicks, engineer in forest products, Forest Products Laboratory, Madison, Wis., under the direction of C. H. Teesdale, a member of this committee, in charge of the section of wood preservation of the Forest Products Laboratory. The compilations given in this report cover sections of test track which have been established by the various railroads and of which careful records are kept. This report has been submitted to this Association and to the American Wood Preservers' Association for their joint use, and takes the place of the compilation of service test records heretofore kept separately by this committee. In this way the duplication of this work by the two associations is avoided.

Outline of Work for Next Year

(1) Continue the compilation of Service Tests, extending them to include piling and structural timbers.

(2) Make a critical study and a resume of some one treatment, such as zinc-chloride, stating definitely what results can be obtained from this treatment under the varying conditions.

(3) Study and report on the results obtained from creosoted timbers in bridges, docks and wharves.

(4) Continue the investigation of the merits of water-gas tar as a preservative, taking samples of the preservative from timbers which have been in use to determine the quality of the preservative.

(5) Co-operate with other committees and associations on wood preservation, with the view of obtaining uniformity in practices and specifications and avoiding unnecessary duplication of work.

(6) Revision of the Manual.

Committee: Earl Stimson (B. & O.), chairman; E. H. Bowser (I. C.), vice-chairman; F. J. Angier (B. & O.), W. J. Backes (N. Y. N. H. & H.), F. C. L. Bond (G. T.), C. F. Ford (C. R. I. & P.), R. H. Howard (Wabash), Geo. E. Rex (A. T. & S. F.), E. A. Sterling (Cons. Engr.), Lowry Smith (N. P.), O. C. Steinmayer (S. L.-S. F.), C. M. Taylor (P. & R.), C. H. Teesdale (Forest Products Laboratory), T. G. Townsend (Soo), Dr. Hermann von Schrenk (Cons. Engr.).

Discussion

Mr. Stimson (chairman): The committee recommends that the specifications for creosote oil analyses be adopted to replace the specifications as printed in the 1915 manual, beginning at the middle of page 642 and running to the middle of page 646. I make a motion to that effect.

The President: Is the committee prepared to say what proportions of this proposed specification are new and what have been approved in the previous reports?

Dr. Hermann von Schrenk: The specifications, which are simply revised as to verbiage and clarification of method, are those appearing under paragraph "(4) Distillation"; in other words, the method for fractioning. This is practically as it now appears in the manual, with some slight changes, which will make the method of designating a standard thermometer more specific, and some slight designations as to the length of the tube to be used in condensation, etc.

The methods under Par. 1, "Water," (2) "Insoluble in Benzol," and (3) "Specific Gravity," and the methods for determining these, and (5) "Specific Gravity of Fractions," are new to this association, but they are practical methods which have been used during the last two or three years very extensively, and have been worked out with a good deal of care by the other joint committees and are in actual laboratory practice in the better laboratories in the country at the present time.

(The President put the motion to vote, and it was carried.)

Mr. Stimson: I move that the clause on sampling of creosote be adopted.

C. E. Lindsay (N. Y. C.): I think, from the standpoint of the manual, that the recommendation of the committee is not in shape for insertion in the manual. It refers to a lot of descriptive reading which is embodied in nine pages of the manual. It seems to me that the committee could condense this description of the zone system of sampling into fewer words. I think they could give the principles of the zone system of sampling more concretely without leaving it in this indefinite way and requiring a member of the association to look through the proceedings as well as the manual.

Mr. Stimson: It is not the intention of the committee to impose any hardship on the members who want to find out anything in regard to these principles. It is our idea, when a new edition of the manual is published, to abstract this matter and reduce it to a number of principles embodying the process.

Mr. Lindsay: I think the committee should be able to put that in shape. By adopting this motion we simply open the door of the manual to the committee to do anything they please.

Mr. Stimson: I do not consider that is the case at all. What we refer to is a complete report on that. That might be condensed in a very few lines, still there is a lot of this matter which is very valuable. We will expect an instruction to arrange for that next year, and we would like in the meantime to place this important matter in such shape, if it is approved by the association, that the members can get the benefit of it.

H. R. Safford (G. Tr.): I think there is a great deal in what Mr. Lindsay has said. Is there not some way by which this matter can be condensed for the manual and a reference made to the fuller report in which it appears?

Mr. Stimson: We say here in this recommendation "the principle of zone sampling be employed, as described in the 1916 report of your committee." All we ask is that the association adopt that at this time, together with this apparatus for sampling. We cannot show the apparatus unless we describe the method by which it is to be used. That information is contained in the pages referred to.

Mr. Lindsay: That apparatus can be recommended for use and the principle of zone sampling can be recommended for use in the proceedings, without putting it in the manual in the form in which they recommend it.

Mr. Stimson: We do not get out another edition of the manual next year, but a supplement, and all that is necessary is to print this one clause in the manual.

Mr. Sullivan: I am inclined to think there is no rule ever made but what should be broken at some time, and I think a man going into the details of buying one of these would go to the proceedings and look for the information he could get on the subject.

W. M. Camp (Railway Review): As I understand it, the principal thing which the chairman of the committee wishes is to have the system of sampling approved of by the association. Mr. Lindsay's statement is that it is not in proper shape for the manual. Could it not be approved by the association and printed in the proceedings?

The President: It will be printed in the proceedings of the association in any event.

Mr. Camp: As I understand it, this matter in the proceedings referred to is largely descriptive. I believe a member of the committee could take that matter and make a very brief statement of it for the manual. It is merely a question of editing. I think it is quite important for the committee's work that this recommendation shall be adopted by the association.

Mr. Stimson: In this we refer to the description of the tests which led up to the conclusions. There are some conclusions which cover about one page. These conclusions, numbering 10, were drawn from the experiments described in the report presented to the last convention, and were approved. I do not think we should deprive our members of the benefit of the description of this apparatus and the method of using it, and I strongly urge the association to adopt this matter as recommended by the committee, and then this technicality, as to how the description of the method would appear in the manual, can be threshed out next year.

The President: Is there any further discussion? If not, the original motion will be voted that this clause be included in the manual.

(The motion was put to vote and carried.)

The President: The committee will be dismissed with the thanks of the association.

Report on Iron and Steel Structures

THE sub-committee submitted a progress report on the Method of Protection of Iron and Steel Structures Against Corrosion, in Appendix A. The following paragraph is recommended for insertion in the Manual:

"Chilled cast-iron plates make the best form of protection to steel work from locomotive blasts. The plates should be placed directly over the tracks and have a width of not less than 30 in. They should be closely joined at their ends to prevent penetration of gases."

The sub-committee on Column Tests reported that the series of tests being made by the U. S. Bureau of Standards under the direction of this sub-committee, have been completed, but that the detailed report thereon is not available at the present time.

A. J. Himes, Chairman

The sub-committee on the Design, Length and Operation of Turntables reported that a further study has been made of phosphor bronze. It has no recommendations to submit, but requests that the railroads use tentatively the specifications printed in Volume 17 of the Proceedings, pages 107-109, inclusive, and report their experience to the sub-committee.

The sub-committee submitted a progress report on the Relative Economy of Various Types of Movable Bridges.

The sub-committee submitted a report on the Impact Tests made on the Norfolk & Western Railway during the summer of 1916, in Appendix C. The following formula is recommended to the Association for adoption and publication in the Manual as a substitute for the impact formula now shown on page 483 of the 1915 Manual:

$$I = \frac{30{,}000}{30{,}000 + L^2}.$$

A proper definition of the terms of the formula shall be made and a statement to the effect that provision for secondary stresses and increase of loading are not intended to be covered thereby.

The sub-committee submitted a progress report on Present Practice in Construction of Ballast-Floor Bridges and Methods in Use for Waterproofing Same, in Appendix D.

Committee: A. J. Himes (N. Y. C. & St. L.), chairman; O. E. Selby (C. C. C. & St. L.), vice-chairman; J. A. Bohland (G. N.), W. S. Bouton (B. & O.), A. W. Carpenter (N. Y. C.), Charles Chandler (I. C.), C. L. Crandall (Cornell Univ.), J. E. Crawford (N. & W.), A. C. Irwin (C. M. & St. P.), F. O. Dufour, J. M. Johnson (I. C.), B. R. Leffler (N. Y. C.), W. H. Moore (N. Y. N. H. & H.), P. B. Motley (C. P.), C. D. Purdon (St. L. S. W.), Albert Reichmann (Am. Br. Co.), J. W. Reid (C. & A.), A. F. Robinson (A. T. & S. F.), H. B. Seaman (Cons. Engr.), C. E. Smith (Cons. Engr.), I. F. Stern (Cons. Engr.), H. B. Stuart (G. T.), G. E. Tebbetts (K. C. T.), F. E. Turneaure (Univ. of Wis.), L. F. Van Hagan (Univ. Wis.).

APPENDIX A

Protection of Iron and Steel Structures Against Corrosion

From our investigations we are of the opinion that: (a) To obtain proper preparation of the steel surface and the application of paint, a special inspector should be used, provided there is sufficient tonnage involved. (b) The bridge company should not be permitted to let shop cleaning and painting out by contract; it leads to end-

less trouble, for the contract is generally taken on a low basis, and the men employed to clean and paint are generally of the cheapest labor and often without experience; the result is that the paint is not properly stirred for application, and is not brushed on the steel. It is thereby wasted by being too thickly applied. (c) It is important to have steel painted under cover during unseasonable weather. (d) It is necessary to have the steel stand until the paint is thoroughly dry, and not shoved out of the shop into the open, possibly on shipping cars, before half dry, with consequent results.

(e) As it is generally conceded that the initial or skin coat is the most important to preserve the steel against corrosion, the greatest care should be exercised in the selection of the paint, the cleaning of the metal, and the application. Specifications should be carefully written with this end in view, and followed with strict and reliable inspection.

The sub-committee is continuing its investigation of the protection of steel with coatings other than paint, and will report more in detail at the next annual meeting.

The sub-committee also has investigated the protection of steel subject to locomotive blasts and gases, and make the recommendation of the following paragraph for insertion in the Manual:

"Chilled cast-iron plates make the best form of protection to steel work from locomotive blasts. The plates should be placed directly over the tracks, and have a width of not less than 30 in. They should be closely joined at their ends to prevent the penetration of gases."

APPENDIX B

Relative Economy of Various Types of Movable Bridges

The committee reported progress and submits an article on Electric Power Input for Railroad Bridges Movable in a Vertical Plane, published in Bulletin 187 as a record of its work during the year. The power tests described in this article were the first of the kind to be made, so far as known. They represent, therefore, original work in an engineering field that is new. Fourteen graphic records of power and 21 tabulated records are shown in this Bulletin.

APPENDIX C

Impact Tests Made During the Summer of 1916 on the Norfolk & Western

At the suggestion of J. E. Crawford, chief engineer of the Norfolk & Western, and with the aid of funds donated by the railroad, the sub-committee on Impact carried out a series of tests on the Norfolk & Western near Bluefield, West Virginia, during the summer of 1916. The particular purpose of these tests was to compare the effect of the electric locomotives used by the Norfolk & Western in that locality with the effect of the consolidation used by the Norfolk & Western in that locality with the effect of the consolidation and Mallet types of steam locomotives.

All the structures tested were short-span bridges of the following types and dimensions—center to center of bearings:

No. 867—39 ft. through girder.
No. 880—65 ft. through girder.
No. 835—84 ft. through girder.
No. 836—85 ft. through girder.
No. 844—96 ft. through girder.

All bridges were plate-girder spans, with the exception of No. 836, which consisted of plate girders under the eastbound track and riveted trusses under the westbound track.

The test loads used in these experiments consisted of: (a) The standard electric locomotive used by this company, consisting of two similar units coupled together. This locomotive was generally followed by a caboose, but the locomotive itself was of sufficient length to cover the structure.

(b) The ordinary type of consolidation locomotive, followed by caboose.

(c) The Mallet type of locomotive, followed by caboose.

(d) Loaded 90-ton coal cars of the Norfolk & Western standard type. These cars were drawn, in some cases, by an electric locomotive, and in other cases by a steam locomotive, but the data reported herein as relating to carloads refer only to the effect of the cars and not to the locomotive.

The electric locomotive used by the Norfolk & Western has crank connections between the motors and the driving wheels, and the driving wheels are connected by means of side rods. Each unit has two motors and two sets of drivers independently connected. As a result of this arrangement, the relative position of cranks and side rods for the two sets of drivers is not fixed and may vary through all possible angles. In the case of the Mallet locomotive the two sets of drivers are also independent in action, and the relative position of the side rods and counterweights may vary through all possible angles.

The apparatus used in these tests was the same as that used in previous impact tests by the committee. Deflection measurements were made by means of a deflectometer attached rigidly to some point of structure near its center. Besides the deflectometer, extensometers were used, these being attached generally to the flanges of the main girders and to a floor beam and stringer. In the case of truss span of No. 836, measurements were also made on the end diagonal. From four to six extensometers were used on the different structures.

The tests were conducted in the same manner as those previously reported, namely, the special test train was run over the structure a number of times at various rates of speed. The first movements were made at a low speed of eight to ten miles per hour, so as to secure readings not affected by impact. The experience of the committee indicates that a speed as low as ten miles per hour produces practically no impact effect in spans such as here considered.

Having made two or three slow runs, the speed of the train was gradually increased to the maximum practicable speed, a number of movements being made at the highest speed. In the case of electric locomotives, the speed was limited to about 28 or 29 miles per hour, by reason of the character of the motors. In the case of steam locomotives, the speed was made as high as practicable, considering safe operation and capacity of the locomotive. On account of the limitation of speed of the electric locomotive to 28 or 29 miles per hour, a special effort was made to secure results from the steam locomotives at about the same speed, as well as at higher speeds.

In previous reports of the committee the subject of critical speed has frequently been referred to and discussed. In the case of a steam locomotive, the rotating parts are not balanced, the counterweights having a weight in excess of the amount necessary to balance the wheels with respect to rotation. The effect of this unbalanced condition of locomotive drivers is to cause the pressure upon the rail to vary considerably from the static pressure, such variation being equal to the centrifugal force of the unbalanced weight. When a locomotive crosses a bridge at just the right speed, the impulses thus produced by the unbalanced drivers will produce a certain amount of vibration in the structure, which is the

chief source of impact. If these impulses are timed so as to correspond to the natural period of vibration of the loaded structure, the effect will be cumulative, and the vibration or impact will be a maximum. The speed of the locomotive which brings about this synchronism of action we have called the critical speed of the locomotive. In the tests in question it was found that the critical speed for the consolidation locomotive varied from about 45 miles per hour for the shortest span to about 33 miles per hour for the longest span. The critical speed for the Mallet locomotive was presumably the same, since the diameters of the drivers were the same; but on account of the variation in the relative position of the counterweights in the two sets of drivers of the Mallet locomotive, the critical speed was not determined so readily. In the case of both of the steam locomotives, a considerable number of tests were made at or near the critical speeds, so as to secure maximum results. In all, 315 runs were made.

Speeds were determined by means of a stop watch and measured base line. While this method is not very exact, it is thought to be sufficiently accurate for the purpose, and is the method used in former tests.

In the case of the Mallet locomotives, a record was made of the approximate relative position of the two sets of counterweights or side rods. This was not determined with great accuracy, but it was found that, by giving careful attention to the movement of the side rods, a fairly accurate estimate could be made. This was rather easy to do when the angle between positions was close to zero, or 180 deg. Owing to the slip of drivers in starting and stopping, the relative position of the two sets of counterweights would change quite rapidly during a series of runs.

Comparison of Results

The electric locomotive produces an impact of 12 to 14 per cent. The consolidation locomotive, at the same speed as the electric locomotive, gives about 15 per cent, and at its critical or maximum speed an impact of from 20 to 25 per cent. The impact from a Mallet locomotive depends very largely upon the relative positions of the counterweights. Where the two sets of counterweights synchronize, the impact is relatively very large, being about 32 to 34 per cent. Where the angle of relative position is about 90 deg. the impact is 15 to 20 per cent, and where this angle is 180 deg., it is but little more than 10 per cent. The impact from loaded cars is from 15 to 18 per cent, somewhat higher than from the electric locomotive.

The results from electric locomotives are, it is believed, somewhat higher than they would be with a well-balanced machine. Some of the impact is, of course, due to vibrations caused by the roughness of wheel and rail, but the experience of the committee would indicate that the results obtained are larger than would be produced by these causes. Information was secured relative to the actual weights of the side rods and counterweights from two of the electric locomotives. From this information, it is found that the additional load due to centrifugal force at 28 miles per hour amounted to about 1.8 per cent of the weight on drivers in one case, and 3.5 in the other. This is not a large amount, and yet, taking into account the cumulative effect on spans more than 50 ft. long, it might readily account for as much as 5 per cent of the impact, or at least half of the amount determined. In the work done by one of the members of the committee in 1898, and reported in Transactions of the American Society of Civil Engineers, Vol. 41, page 435, it was found that some of the locomotives there used were out of balance to a sufficient extent to produce a centrifugal force at 40 miles per hour, ranging from 12 to 19 per cent of the weight on drivers. These same locomotives produced impact effects on plate girders of as much as 30 per cent at speeds of 40 miles per hour or less. The electric locomotives under consideration appear to be out of balance to an extent of from one-third to one-half as much as the steam locomotives in question, and therefore it would seem reasonable to expect an impact effect from electric locomotives at 28 miles per hour of from 5 to 7 per cent, due to the counterweights alone. Tests made some years ago with an electric locomotive at Schenectady, N. Y., indicated a smaller effect than obtained in these tests. This is probably due to a better-balanced condition of the locomotive. If an electric locomotive is perfectly balanced, there should, theoretically, be no impact due to vibration, but a slight impact (perhaps 2 or 3 per cent in case of short spans), due to the rapid application of the load. The impact from the consolidation locomotive at its critical speed was rather less than has been obtained in earlier tests, but there is no special reason why the results from earlier tests with this type of locomotive should not be assumed as safe and proper values to use.

The results from the Mallet locomotive were the most interesting and instructive of all the tests. The effect of the relative position of counterweights is very marked, and is what theory would call for. When the two sets of counterweights act together, the effect is, of course, a maximum, in this case considerably greater than that from the consolidation locomotive. When the two sets act in opposite directions, the impact effect is even less than that produced by the electric locomotive, indicating that with well-balanced parts, both the steam and electric locomotive will produce very small impact. These results are also similar to those obtained previously with balanced compound locomotives.

The effect of loaded cars at a speed of about 28 or 29 miles per hour was considerable, amounting to 15 per cent or more. This rather high result was caused by some condition of wheel or axle which caused the car to vibrate on its springs. Such action of freight cars is often noticeable, and from observations by members of the committee, the vibration corresponds in period to the rotation of the car wheel. In two or three cases, in former tests, the committee has observed a relatively high impact from this cause, but no such effect has been observed from passenger equipment.

Present Practice in Construction of Ballast-Floor Bridges and Methods in Use for Waterproofing Them

The sub-committee sent out the following questions to different railroads in order to find out what the practice is in the construction of ballast-floor bridges and the methods in use for waterproofing them:

Ballast Deck

1. Have you used ballast deck on steel girders or truss bridges?
2. Was the support for the ballast of timber or concrete?
3. If of timber, was it treated, and by what process?
4. Is it your experience that creosoted timber makes the steel rust?
5. What was the dimension of the timber used; what was the span; was the timber longitudinal or transverse?
6. Furnish sketch or print of ballast deck on timber, showing width and depth of ballast; also kind of ballast used.
7. Are the results satisfactory; if not so, what are the defects noted?
8. If the support was of concrete, what were the dimensions of the slabs?
9. What were the details of the reinforcement?
10. Furnish sketch or print of the slabs, showing width and depth of ballast; also kind of ballast used.
11. Were the slabs built in place on the ground alongside the work, or in a central yard?
12. What was the process of placing the slabs and putting the ballast thereon?
13. Were expansion joints provided; if so, in what manner?
14. What percentage of impact do you use for ballast deck as compared with open decks?

Waterproofing

1. Have you used any process of waterproofing of concrete slabs, either on steel spans or concrete trestles?
2. What system of waterproofing was used? Furnish sketch or print.

3. Has the waterproofing proved effective?
4. How long has it been in service?
5. If not effective, state the reasons and by what means it could, in your opinion, have been improved.
6. If not effective, for how long a time was it effective, if any, before renewal or repair became necessary?

Answers were received from 34 railroads, 6 of which, however, did not have any ballast decks.

Of the 28 roads having ballast decks, 11 reported ballast decks on timber and 22 on concrete, some roads having both. One had concrete on steel I-beams, and one used a steel trough floor.

For the timber treatment, 11 reported creosote and 1 had creosote on zinc.

In reply to the question regarding creosote rusting steel 10 replied, "No"; 2, "Not so far"; 1, "Don't know"; 2, "No—as flange was covered"; 1, "Yes," and 1, "Yes, if cinder ballast was used."

In reply to question No. 7, 7 replied, "Yes"; 2, "Yes, generally"; 1, "No"; 1, "Leaks badly"; 1, "Don't know."

Seven railroads used stone ballast; 5, gravel; 1, stone or slag, and 1, chats.

Four reported the bridge sites as the place of manufacture; 1, in place; 5, both; 3, yard; 1, various; 1, general in place.

For placing, 12 replied, "Derrick or wrecker"; 3, "Rolled in."

Fourteen used expansion joints, 4 did not, 2 did in some cases.

For impact, 10 used the same as with an open deck, others varied as shown by the table below:

$\frac{300}{300 + S}$	1
$\frac{LL^2}{LL + DL}$	1
$\frac{300}{L + 300}$	2
90 per cent, E-55	1
90 per cent	1
75 per cent	2
70 per cent	1
50 per cent	2
50 per cent to 67 per cent	1
$\frac{L (L)}{L + D}$	1

Concrete — 40 per cent.

The reports received from the questions on waterproofing are more difficult to tabulate. Twenty-five cases are reported as Membrane system, consisting of Standard Asphalt, Johns-Manville, Hydrex, Cotton Drill, Barrett, Felt, Burlap and Carey; two report the use of an integral system, and six various kinds of paint, pitch, etc.

Discussion

The report was presented by O. E. Selby, vice-chairman.

Mr. Selby: On behalf of the committee, I move the adoption of the paragraph for insertion in the manual.

C. E. Lindsay (N. Y. C.): Is it the desire of the committee that that be put in as a separate item or in the specification? On page 498 of the manual is a specification for cast-iron. Will that specification cover the cast-iron plates recommended here?

Mr. Selby: This is not properly a part of the specification for cast-iron. This is really new matter on the protection of structures against corrosion. It is only the beginning of what may be adopted on that subject.

(The motion to adopt the section was put to a vote and carried.)

Mr. Selby: The tests on impact, as you know, are very important. They are the first made with electrically-operated trains. The matter is so important that I suggest that Prof. Turneaure give a short talk on it and a description of the test.

Prof. Turneaure: These tests were made by the use of three types of locomotives, the electric locomotive, the Consolidation type and the Mallet type. Unfortunately it was impossible to get high speeds with the electric locomotives, the maximum speed being about 29 miles an hour. The speeds in the case of the steam locomotives were somewhat higher. The electric locomotives were of the type in which parallel rods and connecting rods are used, and while it is possible to balance such parts quite perfectly—a thing that is not possible in the case of a steam locomotive—in the case of these particular locomotives the balancing was not very perfectly done; it was not at all necessary to do thoroughly well, because the speeds were not high, so that great pains were not taken to balance the parts as they would have been if the locomotives were to be used in passenger service. Hence we have electric locomotives that are not perfectly balanced.

The other locomotives are not balanced, so far as the rotation of the counterweights is concerned, and the results obtained from these locomotives are about the same as were obtained in a previous test.

The maximum impact percentage obtained in the electric locomotive is about 12 per cent. In the Consolidation locomotives, at the same speed, it is a little more, about 15 or 16 per cent, and at the highest speed at which we could run the engines at this particular point the impact percentages ran as high as 20 to 25 per cent.

We secured very interesting and confirmatory information from the Mallet locomotives. These locomotives have the two independent sets of drivers. They are not, of course, well balanced, so far as rotation of parts is concerned. The effect of the Mallet locomotive in passing over a structure is very different, according to relative position of the parallel rods and the counterweights in the two sets of drivers. If these counterweights in the two sets of drivers are in exactly the same relative position so that both sets are down and both sets are up at the same time, giving a synchronous action to the counterweights then you get a maximum impact effect, the same as you would expect if you had the entire eight drivers rigidly connected. At other times, the locomotive, due to the slipping of wheels, would pass over the structure with the counterweights, in opposite positions, up in the case of one set and down in the case of the other set, so that there would be an opposing tendency from these two sets of drivers.

It is expected that the committee will carry on experiments during the coming summer on the electrified line of the Chicago, Milwaukee & St. Paul in Montana, where we expect to get speeds on ordinary passenger trains of 50 or 60 miles per hour, and we hope to be able to show still more interesting results in a year from now. The locomotives they are using have no side rods or connecting rods, and undoubtedly under those conditions, they will be found to be very perfectly balanced, and, according to our theory, anyway, we should not get any appreciable impact due to the running of these electric locomotives. The Norfolk & Western contributed to the association $1,000 to assist in carrying out this work.

Mr. Selby: Last year, as a result of the impact tests which Prof. Turneaure's sub-committee has been conducting for several years, there was submitted a tentative impact formula. This formula is intended to cover only the effects of impact and to detach from the formulæ now in use the effects of secondary stresses and the factor of ignorance and a few other things that admittedly are included and covered by the so-called 300 formula. That formula has been before the association for some time. It has been confirmed by the additional tests of the past summer, and it is now submitted as a conclusion for adoption and inclusion in the manual as a

substitute for the impact formula now in the manual.

In behalf of the committee, I move the adoption of the formula and its substitution in the manual.

Mr. Lindsay: I think it would be necessary for the chairman to include in his matter that he expects to insert in the manual the new definition for L, because the present definition for L is length of track per foot of load.

Mr. Selby: A proper definition for that term in the formula will be made. That is a matter of editing.

Mr. Safford: I believe the committee had better make a definite statement as to the exact language they propose for that paragraph so that it can be made a matter of record.

The President: Do you wish to refer the impact formula back to the committee?

Mr. Safford: No, they can make that before they leave and submit it to the Board of Direction.

Mr. Selby: We can do that.

(The motion to adopt the formula was put to vote and carried.)

Report on Rules and Organization

C. Dougherty, Chairman

AT the annual meeting of 1916, the committee submitted a clearance diagram in compliance with the instructions of the Board of Direction. The diagram submitted at that meeting was amended and the committee was instructed to reconcile the diagram with that of the committee on Electricity.

In accordance with those instructions, a revised clearance diagram, embodying the amendments and dimensions adopted at the convention of 1916, also showing the diagram for railroads operated by electricity, and the exceptions to which the recommended clearance diagram does not apply, is submitted herewith with the recommendation that the diagram and exceptions be approved and inserted in the Manual.

Conclusions

(1) The clearances recommended are based on the present general practice as to dimensions of equipment.

(2) Any attempt to establish a clearance diagram will be wholly futile unless there be established at the same time a corresponding maximum width for the size of equipment.

(3) The logical course is to prescribe minimum clearances only and to place no restrictions whatever as to maximum clearances.

Recommendations

The following minimum clearances are recommended for new construction, subject to the exceptions which are given below:

Objects

High Switchstands—From center of track to nearest point of stand or target, 7 ft. 6 in.

Intermediate Switchstands—From center of track to nearest point of stand or target, 7 ft. 6 in.

Low Switchstands—From center of track to nearest point of stand, 7 ft. 6 in., except where, on account of stands being placed between parallel tracks, less clearance is required. In such cases the combined height of the stand and lamp to be not more than 2 ft. 6 in. above the base of the rail.

Signal Stands—From center of track to nearest point of stand or target, 7 ft. 6 in. From center of track to center of mast, 9 ft. 6 in.

Low Platforms—9 in. to 12 in. high above base of rail, 5 ft.; 13 in. to 14 in. high above base of rail, 5 ft. 6 in.; 15 in. to 18 in. high above base of rail, 5 ft. 6 in.; 18 in. to 24 in. high above base of rail, 6 ft.

High Platforms—3 ft. 6 in. to 4 ft. 6 in. high, above base of rail, 7 ft. 6 in., or to conform to clearance diagram; 4 ft. 6 in. to 7 ft. 6 in. high, above base of rail, 7 ft. 6 in.

Platform Shelters—7 ft. 6 in., or to conform to clearance diagram.

Mail Cranes, pouch not hung—7 ft. 6 in. from center of track to nearest point of crane.

Mail Cranes, pouch hung—6 ft. from center of track to nearest point of pouch.

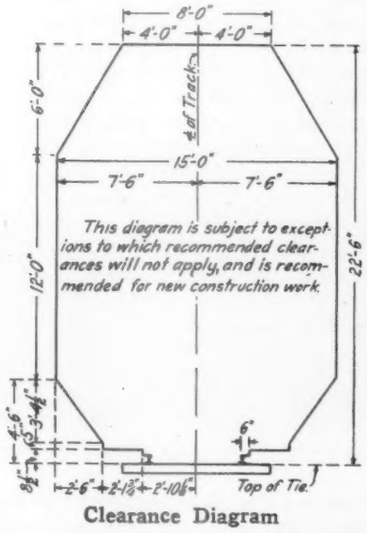
Water Columns—(From 3 ft. 6 in. above to 16 ft. 6 in. above base of rail), from center of track to nearest point of column, 7 ft. 6 in.

Coal Chutes—From center of track to nearest point of apron when not in use, 7 ft. 6 in.; from center of track to nearest point of structure, 7 ft. 6 in.

Tanks and Tank Spouts—From center of track to nearest point of spout when not in use, 7 ft. 6 in.; from center of track to nearest point of structure, 7 ft. 6 in.

Bridge Diagrams—Horizontal width, 15 ft. from 4 ft. 6 in. above to 16 ft. 6 in. above base of rail; top horizontal width, 8 ft.

Parallel Tracks—Between parallel tracks on tangent, 13 ft. On curves a correction per degree of curve should



Clearance Diagram

be made for overhang. The clearance diagram shown herewith is recommended. Corrections should be made for curvature and superelevation of track.

Exceptions to Which Recommended Clearances Will Not Apply

Grade crossing elimination work in cities.

Separation of grades in new construction work in cities or other restricted situations.

Loading platforms along sidetracks at freight houses, warehouses, piers, etc.

Doors of engine houses and other buildings, the design of which makes the recommended clearances impracticable.

Coach or other yards where the available space is very restricted.

New construction work when the physical conditions make the recommended clearances impracticable.

Platforms at coach floor level in subways and other similar situations.

Overhead clearances on tracks used exclusively for passenger service.

Other special situations requiring special clearances.

Committee: C. Dougherty (Southern), chairman; F. D. Anthony (D. & H.), vice-chairman; O. F. Barnes (Erie), L. L. Beall (A. B. & A.), H. L. Browne (C. R. I. & P.), Ralph Budd (G. N., J. B. Carothers (B. & O. S. W.), S. E. Coombs (N. Y. C.), W. H. Finley (C. & N. W.), B. Herman (Southern), A. J. Himes (N. Y. C. & St. L.), F. D. Lakin (Erie), Jos. Mullen (C. C. C. & St. L.), E. T. Reisler, P. T. Simons (M. P.).

Discussion

C. Dougherty (chairman): You will probably recall that the association was requested by the A. R. A. to report on a clearance diagram. This was reported on last year and the diagram is reprinted this year with the understanding that it shows the dimensions adopted by the association last year, and the matter of clearance diagrams is now in more or less definite shape, the part pertaining to electrified roads having been adopted by the American Railway Association and the diagram as a whole is now submitted for the approval of this association.

A. F. Robinson (A. T. & S. F.): In this diagram it seems to me that insufficient provision has been made for snowplows and similar apparatus and machinery that has to be used over the lines. As is generally understood, we ought not to have any interference above the top of the rail. I have made a diagram showing what that interference would be for the snowplows and the rotaries and if anyone wants to look at it, I would be glad to show it. We all know that in this apparatus the front part will go down practically to the rails and we must provide for that in our diagram.

Again, it seems to me that in the lower corner of the diagram where they are providing for the electric equipment they are putting in first a curved rail which is lifted above the traffic rail and quite close to it. Again, they are leaving room for a lot of fixtures which may be put on the top of the ties. There will, as a result, be great danger of mixing the diagram—that is, it does not tell positively whether it is for the equipment running over the line, or whether the clearance is fixed on the deck of the bridge. We must provide for the snowploys and similar apparatus, and it does not seem to me that we should under any conditions consider allowing a current rail or anything of that sort to be run on our bridges which projects above the surface of the track rails.

The President: The diagram to be used on railroads which are electrified has been adopted by this association and the American Railway Association. The effect of this diagram is to limit the dimensions of equipment that is interchanged. This does not prevent any railroad from adopting or using any equipment that it may desire, but when it comes to interchange with other railroads it will have to assume the cost of the interchange.

Mr. Robinson: We have to provide for handling snow and keeping the tracks clear. It does not matter whether it is on an electric road or a steam road. It seems to me whether they have adopted it or not, there should be provision made for just that point.

C. E. Lindsay (N. Y. C.): The upper part of the general diagram was adopted at the last convention, and the duty of the committee today is to reconcile this diagram and the one for electrified roads. That is its whole duty. Both diagrams have been adopted by this association for insertion in the manual. The only duty of the committee is to tie them together.

The President: That statement is correct. There should be a full understanding as to just what these diagrams are. Those who were here last year will remember that there was a great deal of discussion in connection with this clearance diagram. After that discussion dimensions were adopted, and all that was referred to this committee was a simple drawing of a diagram in accordance with the adopted dimensions. Any question as to this diagram raises again the whole question of clearance, which will have to be discussed on its merits. Do I understand that it is the intention to offer as an amendment or as a change in the manual, these changes that are now suggested?

O. E. Selby (C. C. C. & St. L.): I understand that there was considerable doubt as to just what was adopted last year and that it was the duty of this committee to reconcile what was adopted and present as nearly as they could arrive at what was actually adopted in the convention, and submit that for action. If it is ruled that this diagram correctly represents what was adopted last year, then my motion would be to change the diagram in the manual.

The President: The question as to whether or not this diagram conforms to the adopted dimensions is one for the chairman of the committee to answer.

Mr. Dougherty: The committee will state that it is our best knowledge and belief that these diagrams conform to the intended action of the association last year.

Mr. Atwood: I move the adoption of the diagram.

The President: The work of the association in one year is always subject to revision in the following year, and Mr. Selby's motion was in order if the house desired to act on it.

The motion before the house now is for the endorsement of the diagram as shown and as adopted last year.

(The motion was carried.)

REGISTRATION—AMERICAN RAILWAY ENGINEERING ASSOCIATION

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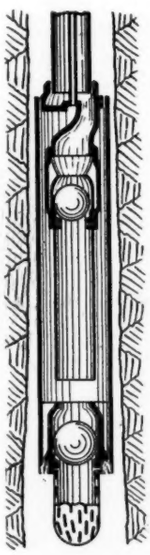
Shields, A. C., Div. Engr., C. R. I. & P., Trenton, Mo.
Tordella, J., Div. Engr., B. & O., Newark, Ohio.
Turneaure, F. E., Dean, Col. of Engr., Univ. of Wis., Madison, Wis.
Wharf, A. J., Chf. Engr., P. & P. U. Ry., Peoria, Ill.
Williams, W. D., Chf. Engr., C. N. R. R., Van Wert, Ohio.

THE TRIP TO GARY

A special train to Gary, Ind., and Buffington will leave the La Salle street station of the New York Central promptly at nine o'clock this morning. Employees of railways entitled to free transportation will be carried upon presentation of their passes, but it will be necessary for others to provide themselves with tickets. The train will stop at Buffington, Ind., to enable those who desire to visit the cement plant only to get off, but the main party will go direct to Gary, where it will go through the plant of the Illinois Steel Company, returning to Buffington in the afternoon. The special train will reach La Salle station on the return trip not later than six o'clock, although it will be possible for those who desire to return earlier to use the frequent suburban service.

AN AIR DISPLACEMENT PUMP

The advantage of the air displacement pump over the air lift was demonstrated in tests made recently on several wells in which trials were made with air lifts and with internal exhaust pumps in which the principle of the air displacement pump is combined with that of the air lift.



The operation of these pumps will be understood by reference to the diagram showing a longitudinal section of the working chamber of the pump, which is submerged below the water surface in the well. Compressed air is admitted through the small pipe at the top, which passes down the center of the water discharge pipe. Water is admitted through the lower or intake valve and when air is applied it depresses the water level in the intake chamber, forcing it into the discharge chamber until the water level in the intake chamber is depressed to the level of the outlet. The pressure at this point slightly overbalances the hydrostatic head of the discharge column and then by virtue of its buoyancy the air ascends the discharge pipe and carries a large percentage of the water with it. This escape of air causes a drop in the air pressure below the hydrostatic head in the well and in consequence the intake valve is opened and the intake chamber is refilled.

This reciprocating process continues indefinitely as long as the supply of compressed air is received through the air inlet pipe. The process is rapid and with the equalization secured through the presence of air in the discharge pipe the intermittent character of the flow is very largely lost. The discharge of the air through the discharge pipe gives the same effect as that secured in the simple air lift, but the displacement action of the air in the intake chamber and the presence of the ball valves insure positive action and absence of slippage.

The results secured in recent tests are indicated in the accompanying tables, which show both an increased discharge and a greater economy with the use of the internal exhaust pump. These pumps are manufactured by the Weber Subterranean Pump Company, New York:

COMPARATIVE TEST DATA.
WEBER PUMPS VS. STRAIGHT AIR LIFTS

Location of Wells and Date of Tests	Perth Amboy, N. J. Jan. 15, 1917		Paterson, N. J. Jan. 20, 1917	
Type of Pump	Straight Air Lift	Weber Pump	Straight Air Lift	Weber Pump
Depth of well (both wells are 8 in. diam.) ..ft.	140	140	450	450
Length of pump.....ft.	140	130	150	300
Lift above ground surface.....ft.	.....	.....	47	47
Free air per minute.....cu. ft.	67	90	106	134
" " gallon delivered.....cu. ft.	3/4	1/2	3/5	5/8
Air pressure.....lb. per sq. in.	43	30	60	70
Quantity of water delivered per min.....gals.	90	180	120	220
" " " " " hour.....gals.	5400	10800	7200	13200
Increase in yield due to Weber pump.per cent.	.....	100%	.....	85%
POWER:				
Water horse power.....	1.2	3.	2½	8.
Indicated horse power	8½	8½	16	21¼
Boiler horse power (i. h. p. x 1½).....	13	13	24	28
Power efficiency (w. h. p.÷b. h. p.)..per cent.	10%	23%	10%	30%
OPERATING EXPENSES PER YEAR (3000 hours):				
Fuel: coal (4¾ lb. per b.h.p. hr.).....tons	88	88	162	189
Fuel: cost at $3 per ton.....$	264	264	486	567
Fuel: cost for secondary pump.....$	.....	.....	336	.....
Interest, depreciation, etc.....$	50	50	100	100
Total operating expenses.....$	314	314	922	667
COMPARISON:				
Quantity delivered per 3000 hrs...million gals.	16	32	21	40
Cost of water pumped per million gals.....$	19.63	9.81	43.90	23.05

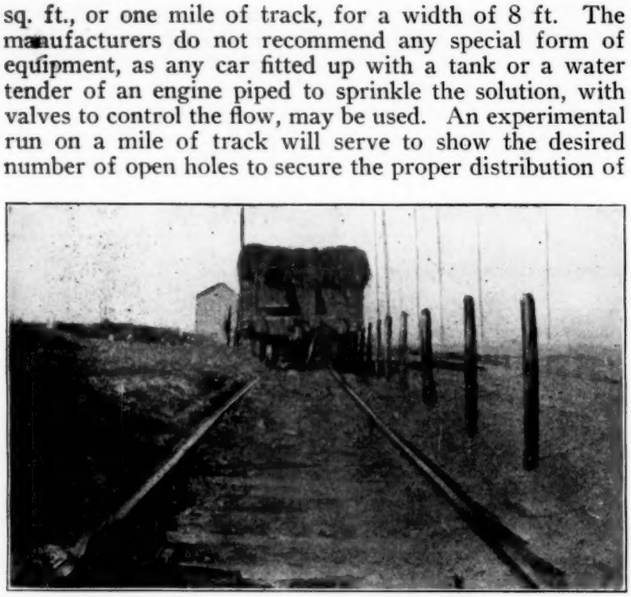
A CHEMICAL WEED KILLER

The economy of providing maintenance of way forces with chemicals for use in destroying weeds in the track rather than to depend upon hand weeding has long been realized. With the increased difficulty of obtaining and retaining labor the necessity for making use of all possible substitutes for manual labor has become imperative and is rapidly increasing the importance of any ready means for destroying weeds.

Before Treatment

One chemical used for this purpose is Trackoline, manufactured by the Protective Materials Corporation, New York City, which has had extended use on railroads and interurban lines. It is furnished in steel barrels containing approximately 50 gal. and weighing 640 lb. The concentrated form thus furnished is diluted with 20 bbl. of water, producing a mixture which, under ordinary conditions, is sufficient for the treatment of 42,000

sq. ft., or one mile of track, for a width of 8 ft. The manufacturers do not recommend any special form of equipment, as any car fitted up with a tank or a water tender of an engine piped to sprinkle the solution, with valves to control the flow, may be used. An experimental run on a mile of track will serve to show the desired number of open holes to secure the proper distribution of



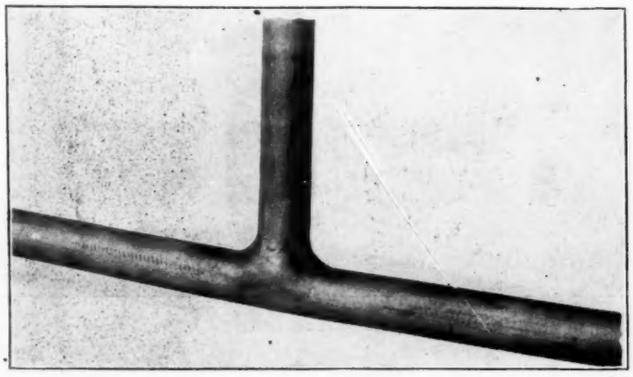
After Treatment

the chemical at the most convenient speed for moving the equipment. The photographs illustrate the change secured with one application.

It is claimed that weeds and grass saturated with Trackoline will not poison cattle or other animals and the material is non-injurious to ties, rails or ballast. The best results are secured by making the application of the chemical in the spring before June 1, as the plants are smaller at this time of the year and are more readily killed.

PREST-O-LITE GAS FOR LEAD WELDING

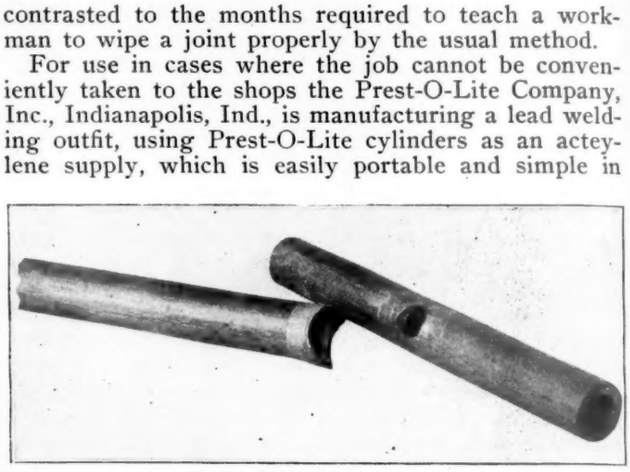
Because of the decreasing use of lead pipe in plumbing the men in charge of water service on railways are often handicapped in carrying on their work by the lack of men in their own forces who are competent to form a lead joint. As a result, the cost of making minor repairs often becomes excessive



The Completed Job

through the need of employing local plumbers. The oxy-acetylene process, which is in general use for welding and cutting metals, and which is now being successfully applied to lead welding as a method of forming joints in lead sheets and pipe, provides the means for correcting this condition. It is said that an intelligent workman can be developed into a fair welder on simple work after a few days' practice, as contrasted to the months required to teach a workman to wipe a joint properly by the usual method.

For use in cases where the job cannot be conveniently taken to the shops the Prest-O-Lite Company, Inc., Indianapolis, Ind., is manufacturing a lead welding outfit, using Prest-O-Lite cylinders as an acetylene supply, which is easily portable and simple in

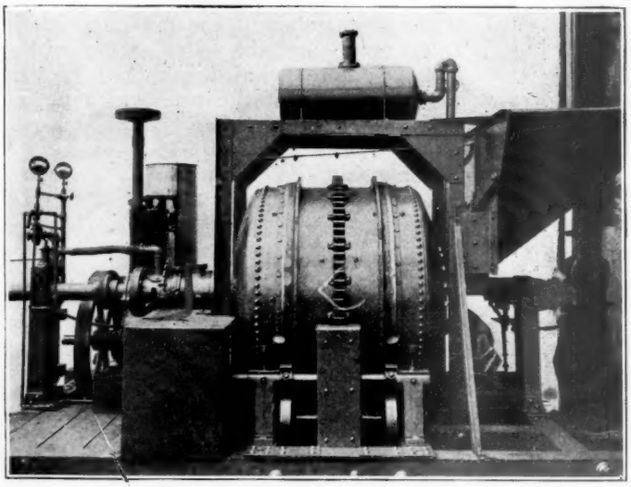


Pipes Prepared for Welding

operation. The outfit is similar to that used in metal cutting and welding and includes oxygen and acetylene cylinders, regulating valves, a blow pipe with its fittings and the necessary rubber tubing. The outfit is also adaptable to shop work and is furnished with complete instructions for lead welding.

IMPROVEMENTS IN PNEUMATIC MIXING

Interesting improvements have been made recently in the pneumatic process for mixing and placing concrete which are expected to broaden the applicability of this method in concrete construction materially. The equipment used in the pneumatic process, as it has been applied in the past particularly for tunnel lining work, consists essentially of a steel hopper provided with an air-tight trap door at the top and connected at its lower end with a six-inch or eight-inch pipe line through which the concrete is discharged 500—1,000 or even 3,000 ft. distant. Compressed air is not only the transporting



Mechanical Mixer with Pneumatic Discharge

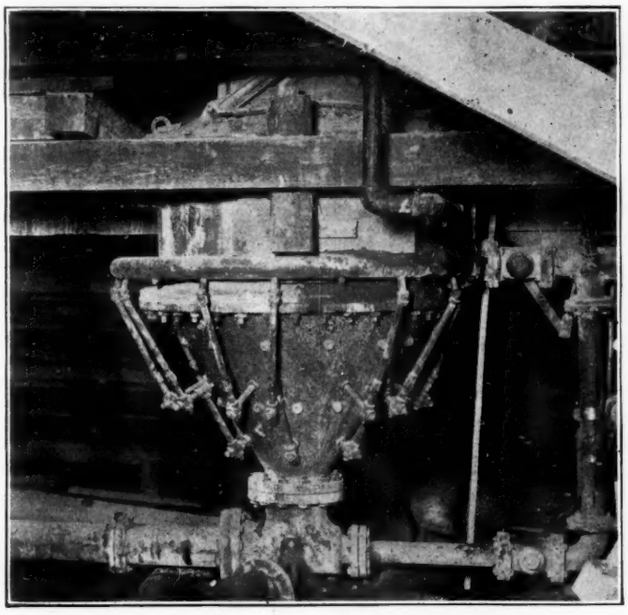
agency, but has been relied upon also to mix the concrete, since the materials are thoroughly agitated in their rapid passage through the pipe line.

One of the recent improvements consists of a new method of delivering the mixing water to the materials. Heretofore it has been dumped in through the trap door along with the other materials, but according to the new system, as shown in one of the pictures, the water is

delivered with the compressed air through a manifold which passes entirely around the hopper and from which it discharges through a great many small pipes that are tapped into the shell of the hopper at various points. With this arrangement the air and water are blown through the contained mass, producing an agitation which is effective in securing a thorough mix before it leaves the hopper. The mixing of the concrete is in consequence independent of the length of transmission pipe through which the material is discharged.

Another modification recently worked out involves the combination of mechanical mixing with pneumatic transmission and has the advantage that the delivery of the charge is distributed over a material interval of time. This permits the use of a three or four-inch pipe for the delivery line in place of a six-inch or eight-inch pipe, which is required under the older system with which the charge in the hopper is delivered all at once.

One of the illustrations shows this equipment. The device consists of a drum similar to that used in the common batch concrete mixer except that it has an air-tight



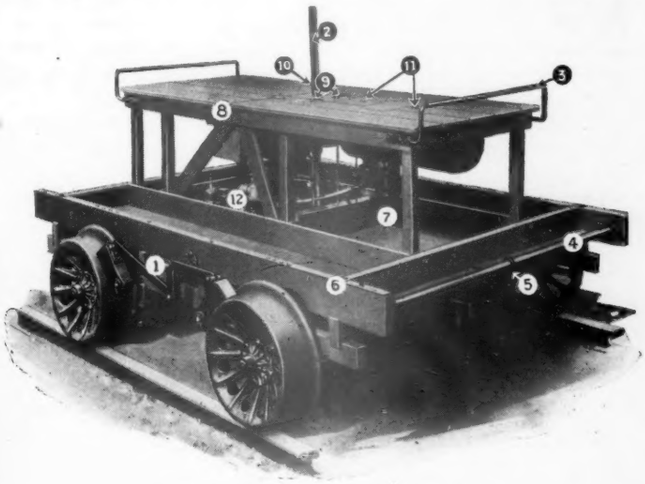
Hopper Equipped with Improved Water Delivery

inlet door and no outlet other than a three or four-inch discharge pipe. The latter extends into the drum on its axis of rotation and is equipped near the center of the drum with a hopper which receives the load of concrete carried up in each blade of the mixer drum as the latter revolves on its axis. The section of the discharge pipe within the drum is arranged to revolve 180 deg. on its axis so that the hopper may be turned bottom side up when it is desired not to discharge concrete.

When ready to discharge the hopper is turned up, air pressure is applied and each blade full of concrete is discharged into the pipe in turn. Pipe three inches or four inches in diameter is all that is required. Concrete containing stone passing a 1½-in. diameter ring has been successfully blown through a 3-in. pipe. The more continuous flow of the material attending the use of this method reduces the impact or jar occurring at the point of discharge. This reduces the service to which the forms are subjected and decreases the difficulty of handling the discharge pipe. The mixer will hold 21 cu. ft. of concrete material and under advantageous conditions can deliver a two-bag batch every minute. The air pressure on the pipe line is about 25 lb., but the air inlet pipe is calculated for a pressure of 60 to 80 lb. per sq. in. The minimum air capacity required is 300 to 400 ft. of free air per minute, increasing with the length of the discharge pipe. This equipment is manufactured by the Ransome Concrete Machinery Company, Dunellen, N. J., and the Pneumatic Placing Company, New York.

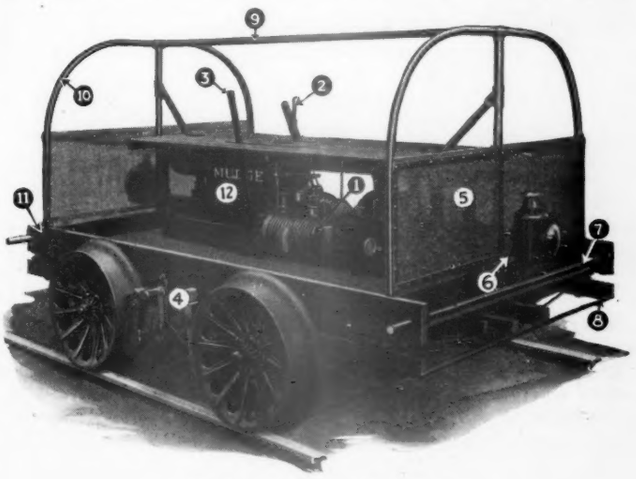
NEW MOTOR CARS

Two new motor cars were recently placed on the market by Mudge & Co. which embody some interesting features. One of these, the E S-2-K, is



The Mudge ES-2-K Motor Car

equipped with a two-cycle, air-cooled twin engine power plant that burns kerosene for fuel. The two cylinders operate individually. In other words, only one need be used at a time if operated under light load or on easy grades. Both engines are cut in when full power is required. The car is also equipped with a double compartment tank—the engine first being started on gasoline and then switched to kerosene as



Mudge GS-3 Section Car

soon as it is warmed up. A special heater arrangement for the exhaust is provided which warms the fuel and aids combustion in cold weather.

The car weighs 875 lb. and develops eight horsepower. It drives through machine cut, case-hardened gears, which are constantly in mesh, and handles a fully loaded trailer in addition to 10 men on the

seat board. It has ample carrying space for tools. The brakes act on all four wheels and the car operates in either direction.

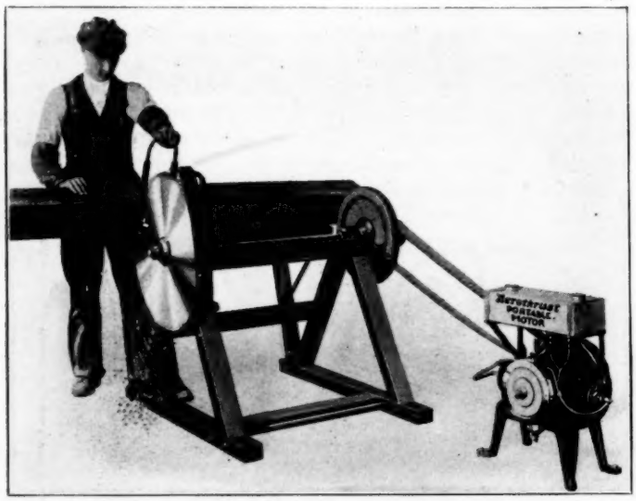
The other new car is the G S-3 section car, in which a particular effort has been made to secure safety. Many details have been added that will prevent accidents and eliminate the causes of pinched fingers, injured feet, legs and arms. The overhead rail, which is centered on the car, can be easily grasped by the men riding, regardless of where they are sitting on the seat board. This gives security when the car is in operation and makes it practically impossible for the men to fall off. The heavy wire netting construction placed across each end avoids dangerous loading. In addition it holds all tools in place and serves as a guard for the men in case the car is brought to a sudden stop. The high side rails on the platform guard against contact with turning wheels. The lights, both front and rear, add safety to night travel.

The safety devices used on this car are patented by Mudge & Co. and can be applied to any of their Section types.

This car is equipped with a large bore, long-stroke, air-cooled, two-cycle engine, developing six horsepower. The engine runs free when desired. The power is transmitted by belt to a pulley on the driving axle. In addition to eight men on the car, a fully loaded trailer can be handled. The car weighs 885 lb. complete with safety devices.

A PORTABLE GAS ENGINE

With the increased use of labor-saving equipment for railway maintenance work the fear is occasionally expressed that this tendency will lead to the accumulation of a large number of units of equipment designed for

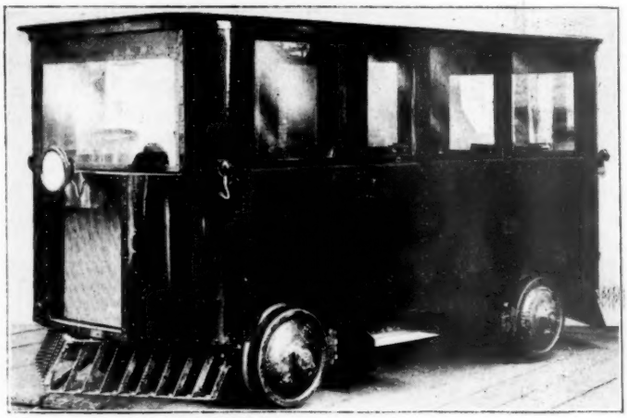


Furnishing Power for a Saw

special purposes which will be in actual use only a small portion of the total time. In consequence there is a definite field for any device which can be used readily in a number of varied activities. As an example of this may be mentioned the small portable gas engines manufactured by the Aerothrust Engine Company, La Porte, Ind. These are made in two sizes, one of 3 hp. weighing 115 lb., and another of 5 hp. weighing 150 lb. Thus they come within weights that are readily handled by one or two men. The engines are designed with a view to making them readily adaptable to various purposes. With small modifications they may be coupled to centrifugal pumps having capacities of 125 and 250 gal. per min., respectively, at a 30-ft. head. The illustration shows one of these engines belt connected to a sawing outfit. The engine is of the air-cooled two-cycle type with two cylinders opposed on a single crank and have high-tension built-in fly wheel magnetoes.

A NEW INSPECTION CAR

A new type of railway inspection car has been developed by Geo. P. Nichols & Bro., Chicago, to meet the needs of officers who desire to go over the line for inspection or other purposes quickly and comfortably, without the necessity of making up a special



The Nichols Inspection Car

train or attaching a private car to regular trains. This car measures about 14 ft. over all, is designed ordinarily to carry 8 or 9 passengers and is propelled by a 3½ in. by 5¼ in. four-cylinder, water-cooled gasoline engine located within the car, the driver and one passenger having seats on either side of the engine. As the floor is low, a very much better opportunity is afforded for track inspection than from a regular coach.

The unit power plant includes a dry-plate clutch, a two-speed transmission and a spring coupling between the engine and the transmission. The reversing mechanism is integral with the rear axle and the car, therefore, can be operated on direct drive at full speed equally well in either direction. A radiator of very large capacity is located in the front of the car, arrangement being made for reversing the fan conveniently when the car is run backwards. The car is designed to be operated ordinarily at speeds of 30 to 35 miles per hour, but can be geared for operation at higher speeds if desired. The control is simple and convenient, all gear shifting and reversing being accomplished with a one-hand lever. The standard equipment includes electric lighting and starting. All mechanical parts have been specially designed for severe use and for conditions incident to the use of metal wheels.

This car may be built with open sides and canopy top or entirely enclosed, with drop sash. The latter type lends itself more readily to service all the year round, independent of weather. The car is capable of being adapted to small branch line passenger service by increasing the length of the body, and, therefore, the space for seating, but primarily it is intended for the use of railroad officers who require a better and more complete equipment than is afforded by the ordinary section cars. The design is new, but seven cars are already in regular service. These cars are sold by Fairbanks, Morse & Co.